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STATE OF NEW YORK

FORTY-FIRST ANNUAL REPORT

OF THE

STATE DEPARTMENT OF HEALTH

For the Year Ending December 31, 1920

VOLUME II

Report of Division of Sanitary Engineering

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1921

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STATE OF NEW YORK

EXECUTIVE CHAMBER,

ALBANY, *April* 12, 1921.

To the Legislature:

I have the honor to present herewith the forty-first annual report of the State Commissioner of Health for the year 1920.

NATHAN L. MILLER.

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NEW YORK STATE DEPARTMENT OF HEALTH

Division of Sanitary Engineering

Chief Engineer	Theodore Horton
Principal Assistant Engineer	Charles A. Holmquist
Assistant Engineer	Henry Ryon
Assistant Engineer	Earl Devendorf
Assistant Engineer	W. W. Young
Assistant Engineer	Alfred Mullikin
Assistant Engineer	Albert I. Howd
Inspecting Engineer	W. C. Emigh
Sanitary Inspector	W. John Erickson
Sanitary Inspector	Jacob H. Weber
Sanitary Inspector	Nathan H. Baier

Resignations During Year

E. Sherman Chase, Assistant Engineer
Charles A. Howland, Assistant Engineer

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REPORT OF CHIEF ENGINEER

Hermann M. Biggs, M. D., *Commissioner of Health, Albany, N. Y.:*

Dear Sir.— I have the honor to submit herewith the annual report of the Division of Sanitary Engineering for 1920.

The work of the Engineering Division for 1920 reflects in a general way the same characteristics that have been apparent in nearly every professional and industrial field, namely, an unusual activity in almost every line of work and under trying conditions of professional employment. This situation is, of course, a direct outcome of war conditions, and until sanitary engineers with training and experience essential to the work of the Engineering Division can be more readily obtained within the appropriations granted by the Legislature, or until present unusual demands upon our resources resulting from inactivity during the war has been reduced to normal, there will undoubtedly be little relief from these difficulties.

The activities of the Engineering Division, briefly stated, include the examination and approval of plans for sewerage systems and sewage disposal works; supervision of the sanitary quality of the public water supplies of the State; the investigation of major public nuisances generally, and specifically when called upon under order from the Governor; the examination and reports of the sanitary conditions of state institutions; the supervision of construction and operation of milk pasteurizing plants; the examination and approval of plans and budgets for Nassau County Mosquito Extermination Commission; advice to and approval of plans for water supplies and sewage disposal systems of county tuberculosis hospitals; the investigation of waterborne outbreaks of typhoid fever; consulting advice to municipalities, corporations, and individuals in regard to all phases of sanitary engineering work; and educational and research work so far as these were possible within limited resources.

The work of the Engineering Division for 1920 may perhaps be most clearly and briefly presented in the following list, which includes numerically the work performed by the Division according to its more important subdivisions and also includes for purposes of comparison the figures for the year 1919.

	1919	1920
Letters and other correspondence referred to Division	2,666	3,020
Letters and reports sent out	4,323	4,444
Plans examined and reported upon	125	127
Investigations of public water supplies	154	193
Investigations of sanitary conditions of state institutions	14	30
Investigations of sewage disposal plants	17	16
Investigations relating to sewerage systems	10	13
Investigations of milk pasteurizing plants	403	166
Investigations of stream pollution and nuisances	47	68
Conferences held with local officials	328	357
Lectures and addresses by staff	6	7

Among those features of the work of the Division during 1920 which may be considered as of more than usual interest or importance may be mentioned, first, the special investigation of the sanitary conditions of certain public gathering places in the State, more particularly the some fifty camps in the Palisades Interstate Park reservation in which some 75,000 boys and girls congregate during the summer months; and the some eighty county and other fair grounds in the State where more than 1,500,000 persons congregate during the fair season. The questions of pure water supplies and sanitary methods of garbage and sewage disposal at these camps and fair grounds are obviously matters of fundamental importance, and the investigations and reports have been directed toward determining wherein and to what extent these various features are defective or insanitary and have concluded with certain definite recommendations that should be followed in order that these camps and fair grounds may be placed in proper sanitary condition.

Another feature of importance in the work of the Division has been the special investigation and consulting advice to the Department of the State Engineer and Surveyor and the Department of Architecture in connection with new or increased water supplies and sewage disposal systems for new state institutions or extensions of existing institutions. These relate to the new state hospital for the insane at Marcy, the new Wingdale prison, and extensions to the state hospitals at Beacon, Gowanda, Rome, and Raybrook.

Other investigations having a very important bearing upon the public health of the State include a special investigation and action by the department in the protection of public water supplies of the State against contamination by impure auxiliary or industrial fire supplies, in connection with which a number of typhoid fever outbreaks have occurred during the past few years; and a special investigation and epidemiological studies in connection with certain outbreaks of water-borne diseases other than typhoid fever, a number of which have also occurred in the State during the past few years.

In the field of research work and advancement of engineering knowledge generally may be mentioned practical experiments in the purification of oysters; development of new types and designs in screens and tanks for the purification of sewage; practical experiments in the sedimentation of sewage at Syracuse in connection with its problem of sewage disposal; and practical experiments and full sized installations of apparatus and methods for deodorizing and eliminating objectionable waste gases and odors from certain industrial establishments at Edgewater, N. J., which have been the source of serious nuisance to a large residential section of New York city.

Owing to serious difficulties experienced during the past few years in securing properly trained and experienced engineers, and to many resignations of men called to more lucrative positions in the consulting and industrial field, attention cannot be too strongly focused upon the necessity of financial relief if the volume and efficiency of the work in past years is to be maintained. As a step toward relief in this direction, and in order to improve the conditions of employment generally and make them more comparable and uniform with other engineering departments of the state service, a uniform classification of positions in the Division with commensurate salaries has been asked of and approved by the Civil Service Commission. If this new classification with necessary appropriations is approved by the Legislature, the present serious handicaps to efficiency of work and integrity of organization will be largely removed.

Respectfully submitted

THEODORE HORTON

Chief Engineer

December 31, 1920

SEWERAGE AND SEWAGE DISPOSAL

EXAMINATION AND APPROVAL OF PLANS FOR SEWERAGE AND SEWAGE DISPOSAL

The examination of plans for sewerage and sewage disposal for municipalities under the provisions of the Public Health, Village, and Town Laws, which require that all such plans be submitted to this Department for approval before construction may be undertaken, comprises one of the more important routine duties of the Engineering Division. Plans for new sewerage and sewage disposal systems are carefully studied not only with reference to the details of the design and the adequacy of these systems but also with respect to the location of the outlets and the extent of the treatment of the sewage in order that not only the municipalities themselves but lower riparian owners and municipalities may have their public water supplies protected and free from any nuisance arising from sewage pollution.

During the year 1920 some 127 sets of plans for sewers, sewerage systems, and sewage and waste disposal have been examined and reported upon by the Engineering Division. Brief descriptions of the different plans recommended for approval, together with the permits issued in connection with their approval and complete reports upon the examinations of the plans for the more important installations proposed, are given below.

AVON

Plans for a proposed sewer extension in Rochester street, in the village of Avon, were approved on April 1, 1920. The permit issued in connection with the approval of these plans contained, in addition to the usual revocation, modification, complete construction, and storm water clauses, the following condition:

That a manhole be constructed at the junction of the lower end of the proposed 6-inch sewer with the existing 6-inch sewer.

BEDFORD (Town) (Property of E. O. Holter)

On March 9, 1920, plans were approved for a sewage disposal plant consisting of a settling tank, dosing chamber, and subsurface irrigation system to treat the sewage from a cottage on the property of Mr. E. O. Holter. Since the property is located on the watershed of Croton lake, one of the sources of water supply of New York City, the plans were submitted to the Department of Water Supply, Gas and Electricity of the city of New York for approval, and were approved by that Department on March 1, 1920. The permit issued by this Department in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Mr. E. O. Holter to discharge the effluent from the proposed sewage disposal plant to serve the cottage on his property in the town of Bedford into the ground waters of the State tributary to Croton lake, within the town of Bedford, Westchester county, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal works.
5. That no sewage sludge from any part of the disposal works shall be discharged into Croton lake or any tributary thereof, or any other water course, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.
6. That when necessary the sludge shall be removed from the proposed tank in such a manner as to cause no nuisance and disposed of by burying in some remote place.

M. NICOLL, JR.
March 9, 1920 *Deputy State Commissioner of Health*

BEDFORD HILLS (State Reformatory for Women)

Plans submitted by the State Architect for certain repairs and improvements to the sand filters and surrounding embankments at the sewage disposal plant of the New York State Reformatory for Women at Bedford Hills were approved on April 7, 1920. Amended plans for repairs to the sewage disposal plant were approved on July 9, 1920.

BEEKMAN (Town) (Sylvan Lake Camp for Girls)

Plans were approved on June 11, 1920, for 3 separate sewage disposal plants, each consisting of a settling tank and leaching cesspool, for the disposal of sewage from the Sylvan Lake Camp for Girls at Sylvan lake, in the town of Beekman. The permit issued in connection with the approval of these plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to The Hopewell Realty Company to discharge sanitary sewage from the underdrainage of leaching cesspools at Sylvan Lake Camp for Girls, near Beekman, into the ground waters tributary to Sylvan lake, within the town of Beekman, Dutchess county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That sewage disposal plants serving the easterly and westerly wash-houses shall be removed at least 100 feet farther east and west respectively from the points shown on the plan.
2. That the sewage disposal plant to serve the kitchen and mess hall shall either be located not less than 400 feet west of the kitchen and mess hall, or that the sewage from the kitchen be discharged into the sewer or sewage disposal plant serving the westerly wash-houses.
3. That additional leaching cesspools shall be installed whenever required, or some other suitable method of disposal of the sewage from this camp shall be provided when required under plans which must first be submitted to and receive the approval of the State Commissioner of Health.
4. That the sludge shall be buried or otherwise disposed of without nuisance, and that no sludge shall be discharged into any stream or body of water or upon the surface of the ground where it might be carried by rain or melting snow into such stream or body of water.

M. NICOLL, JR.
June 11, 1920 *Deputy State Commissioner of Health*

BINGHAMTON

Plans were approved on June 28, 1920, for proposed sewers in North Way street, Stowe driveway, and Stowe avenue, in the city of Binghamton. The permit issued in connection with the approval of these plans contained, in addition to the usual storm water and complete construction clauses, the following condition:

That whenever required by the State Commissioner of Health the sewage to be collected by the proposed sewer extensions shall be conveyed to and treated in sewage disposal works to be constructed by the city of Binghamton to care for the entire sanitary sewage of the city under plans to be submitted to and approved by this Department.

BRIARCLIFF MANOR (Briarcliff Manor Realty Co.)

Plans were approved on February 21, 1920, for proposed extensions to the temporary sewage disposal plant serving the village of Briarcliff Manor. **The plans contemplated the installation of an additional pump and the construction** of a new absorption field. The permit issued in connection with the approval of the plans follows. On October 25, 1920, the time limit specified in the permit was extended from October 31, 1920, to October 31, 1921.

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to The Briarcliff Manor Realty Co. to discharge the effluent from the proposed addition to the disposal plant serving Briarcliff Manor into the ground waters of the State tributary to Pocantico river at the point shown on the plan within the municipality of Briarcliff Manor, Westchester county, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That this permit shall expire on October 31, 1920.
4. That after October 31, 1920, the sewage to be disposed of on the temporary absorption field provided for by the plans approved this day shall be disposed of in accordance with plans heretofore approved by this Department.
5. That the proposed additional disposal works provided by the plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereto and that no portion of the absorption trenches shall be less than 200 feet from the Pocantico river.
6. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal plant.
7. That no sewage or sewage sludge from any part of the disposal works shall be discharged or allowed to flow into the Pocantico river or any other watercourse, or be deposited on the ground where it may be washed by rain or melting snow into any watercourse.

M. NICOLL, JR.
February 21, 1920 *Deputy State Commissioner of Health*

BRIGHTON (Town) (Sewer District No. 1)

On January 7, 1920, plans were approved for altering and enlarging the sewage disposal plant which serves Sewer District No. 1 in the town of Brighton, Monroe county. The report upon the examination of the plans and the permit issued in connection with the approval of the plans follow:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on the examination of plans for altering and enlarging the sewage disposal plant to serve Sewer District No. 1 in the town of Brighton, Monroe county, N. Y., submitted to this Department for approval by the engineer on December 29, 1919.

According to the records of this Department, plans for a disposal plant to serve Sewer District No. 1 were originally approved by this Department on August 29, 1914. At that time the district comprised about 120 acres and the ultimate future population of this area was estimated at 1,940. The plant consisted of a pumping station, a two-story settling tank, a dosing chamber, and intermittent sand filter beds. The settling compartment of the tank had a capacity of 14,000 gallons and the sludge compartment an available capacity of 1600 cubic feet. The area of the sand beds was 1.3 acres. The plant was considered to have a sufficient capacity easily to care for the sewage of 1,000 persons.

On August 6, 1919, plans for certain extensions to the sewerage system for Sewer District No. 1 to serve a new area recently added to the district were submitted to this Department for approval. The new area added has an area of 135 acres and an estimated future population of 2,505 persons, making the estimated future population of the entire district 4,445 persons. It was stated, however, at the time the plans were submitted, that the entire population of this district was then not over 100. The plans for the extensions to the sewerage system, including a necessary pumping station, were approved on August 12, 1919, with the condition that on or before January 1, 1920, additional plans for additions to the existing sewage disposal plant should be submitted to this Department for approval, and that before the population of the district should exceed 1,000 these additions should be constructed and put in operation.

The plans now submitted contemplate the construction of a new settling tank and dosing chamber to be used in connection with the old tank, the abandonment of the present dosing chamber, and the replacement of the present sand beds and sludge bed with larger sand filter beds and a larger sludge bed. The sewage from the pumping station will be discharged into a trough connecting the old and new settling tanks, flow through the two tanks which are connected in parallel, and discharge into the new dosing chamber lying between them, from which it will be distributed by 4 automatic siphons on to the sand beds. The effluent from the sand beds will discharge into the creek which receives the effluent from the present plant.

The proposed new two-story settling tank is to be of concrete, 19 feet by 28 feet in plan, and 24 feet 6 inches deep from the flow line to the bottom of the 3 hoppers forming the bottom of the tank. The settling compartment is separated from the remainder of the tank by 6-inch longitudinal concrete partitions the lower part of which slope toward a central longitudinal slot with an inclination of 1.2 on 1. This slot is protected by a beam of triangular cross section overlapping the slot by 12 inches on each side, and allowing an 8-inch opening on each side through which the solids settling out of the sewage may fall into the sludge compartment. The slope of the sides of the triangular beam are only 0.8 on 1, and it would seem desirable that this slope be made at least equal to that of the partitions in order to avoid clogging of the slots by the accumulations of sludge on the top of the triangular beam. Gas vents 3 feet wide connected to the sludge compartment extend the entire length of the tank on each side. The sewage enters and leaves the tank over wrought-iron weirs extending the full width of the settling compartment at each end. The outlet weir is protected by a wooden scum board set 12 inches from the weir and extending from 2 inches above to 2 feet 6 inches below the surface of the liquid in the tank. Three 8-inch sludge pipes, one extending to the bottom of each hopper, provide a means for drawing off the sludge and discharging it on to the sludge bed.

The capacity of the settling compartment is approximately 30,000 gallons, and the available capacity of the sludge compartment about 2,400 cubic feet. Since this tank is to be operated in connection with the old tank, the total settling capacity available will be 44,000 gallons, and the available sludge capacity 4,000 cubic feet. Assuming a sewage flow of 100 gallons per capita per day, and that the desirable average detention period for fresh dilute sewage such as will be received here is about 2.5 hours flow, the tanks should serve satisfactorily about 4,000 people. With this population the sludge capacity would be about 1 cubic foot per capita which generally proves sufficient.

The dosing chamber is a covered concrete tank 15 by 26 feet in plan having an available depth of about 4 feet. The capacity of the chamber is 11,600 gallons, or 1,650 cubic feet, the equivalent of about 35 minutes average flow or a depth of approximately ½ inch on one sand bed. This capacity could be undoubtedly increased with advantage, for the quantity dosed at each discharge is scarcely sufficient to produce a uniform distribution on the entire sand bed. The capacity of the dosing tank should be increased sufficiently to provide a dose equivalent to not less than one inch over the surface of one sand filter bed, and the size of the siphons increased to 14 inches in order to secure a uniform distribution of the sewage over the beds. Four 10-inch automatic siphons are provided to arrange to distribute the contents of the dosing chamber on to each of the 4 sand beds in turn.

Four sand beds of irregular shape are provided each having an area of about 0.86 of an acre. The filtering material consists of 36 inches of sand having an effective size between the limits of 0.2 m.m. and 0.5 m.m. placed on a 6-inch layer of gravel. The effluent from the dosing chamber is distributed on the beds by means of wooden troughs 12 inches deep and varying from 12 inches to 6 inches in width. Lines of 6-inch drain tile with ¼-inch open joints, laid 10 feet on centers in the gravel on the bottom of the beds, collect the effluent and conduct it to a 10-inch main underdrain which discharges into the creek.

The total area of the sand beds is about 3.5 acres, providing sufficient area to care for a population of approximately 3,500 people, a little less than the population that can be readily cared for by the tanks and about 80 per cent of the estimated future population of the area. According to the report of the engineer, it is expected that within a short time, and long before the population reaches that just mentioned, the district will be taken into the city of Rochester, and other provisions made for the disposal of the sewage.

In view of the above, and after a careful consideration of the essential features of the design and of local and general conditions, I would recommend that the plans be approved, and a permit issued allowing the discharge of the effluent from the proposed sewage disposal plant for Sewer District No. 1, town of Brighton, Monroe county, N. Y., into Allen creek within the town of Brighton, with the following condition in addition to the usual revocation and modification clauses:

1. That the capacity of the proposed dosing tank shall be increased sufficiently to provide for a dose equal to a depth not less than one inch on each sand filter bed.
2. That the size of the siphons be increased to 14 inches.
3. That before the flow of sewage tributary to the proposed sewage disposal plant shall exceed that contributed by 3,600 persons, the proposed sewage disposal plant shall be modified or extended in accordance with plans which must first be submitted to and receive the approval of the State Department of Health and put in operation.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *January* 3, 1920

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Sewer Commissioners of Sewer District No. 1, of the town of Brighton, Monroe county, N. Y., to discharge effluent from the proposed sewage disposal plant to serve Sewer District No. 1, town of Brighton, into the waters of Allen creek at the points shown on the plans within the town of Brighton in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers.
5. That no sewage sludge from any part of the disposal works shall be discharged into Allen creek or any other watercourse or be deposited on the surface of the ground where it might be washed by rain or melting snow into Allen creek or any other watercourse.
6. That the capacity of the proposed dosing tank shall be increased sufficiently to provide for a dose equal to a depth not less than one inch on each sand filter bed.
7. That the size of the siphons be increased to 14 inches.
8. That before the flow of sewage tributary to the proposed sewage disposal plant shall exceed that contributed by 3,600 persons the proposed sewage disposal plant shall be modified or extended in accordance with plans which must first be submitted to and receive the approval of the State Department of Health, and put in operation.

M. NICOLL, JR.
January 7, 1920 *Deputy State Commissioner of Health*

BRONXVILLE

Plans were approved on January 19, 1920, for the proposed reconstruction of the sewer extending from the south end of Meadow avenue across private property to Kraft avenue, in the village of Bronxville. No permit was issued in connection with the approval of these plans.

BROOKHAVEN (Town) (Suffolk County Tuberculosis Hospital)

Amended plans for the disposal of sewage from the Suffolk County Tuberculosis Hospital, near Holtsville, were approved on December 8, 1920. The plans provided for the construction of a new settling tank and the addition of one cesspool to each battery of cesspools. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by article V of the Public Health Law, permission is hereby given to the Board of Managers of the Suffolk County Tuberculosis Hospital to discharge effluent from the proposed disposal plant into the ground waters tributary to Patchogue creek within the town of Brookhaven, Suffolk county, N. Y., in accordance with the plans accompanying the application, under the following conditions:

1. That an ample overflow aperture be provided through the sludge wall nearest the outlet in the treatment tank.

2. That with the exception of the foregoing condition, the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal works.

4. That when necessary the sludge shall be removed from the proposed tank, at least once a year, in such a manner as to cause no nuisance and disposed of by burying in some remote place.

5. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for treatment of the sewage of the hospital shall be submitted for approval; and upon the approval of said plans any or all portions of such additional or supplementary works for treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.
December 8, 1920 *Deputy State Commissioner of Health*

BROWNVILLE

Plans were approved on December 14, 1920, for a proposed sewer system and disposal plant for the village of Brownville, Jefferson county. The report upon the examination of the plans and the permit issued in connection with the approval of the plans follow:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I wish to submit the following report on our examination of the plans for the proposed sewer system and disposal plant for the village of Brownville, Jefferson county, N. Y., submitted to this Department for approval by the consulting engineer for the board of trustees on December 9, 1920. The plans were submitted in duplicate, and were accompanied by an engineering report, specifications, and an application for the approval of the plans and the issuance of a permit. An application asking for permission to omit temporarily the construction of the disposal plant and certain portions of the proposed sewer system was also submitted.

Brownville was incorporated in 1828, and had a population of 854 in 1910 and 998 in 1920. It is located on the Black river, about 4 miles below Watertown, at a point on the north bank of the Black river about 4 miles above where it discharges into Black River bay, an arm of Lake Ontario. The village of Dexter, which has a population of 1,200 people, is located near the mouth of the river, and is the only populous settlement on the river below Brownville. The Black river is not used as a source of public water supply below the village, and a number of municipalities, including the city of Watertown, are at present discharging untreated sewage into this stream above the village. Brownville has at present neither a public water supply nor a sewerage system.

The plans now under consideration were previously submitted on December 1, 1920, and were returned the following day, with a request for additional information on certain points and suggestions for amendments along the following lines:

1. That sewers be shown on all streets.
2. That railroad and brook crossings and drop manholes be shown in detail.
3. That slopes giving low velocities be increased.
4. That the sludge compartment in the treatment tank of the disposal plant be enlarged.

5. That certain other modifications be made in the disposal plant.

A number of conferences with the designing engineer were also held at the office of the Engineering Division of this Department at which other revisions in the plans were suggested.

The plans now submitted have been amended in general accordance with our recommendations, and the information requested is also given. The plans are comprehensive, and show by contour map embracing the village limits that all portions of the village may be made tributary to the sewer system, and sewers are shown on all present and proposed streets. Although it is planned to discharge temporarily the sewage to be collected by the proposed system directly into the Black river through a submerged outlet at the foot of Storehouse alley, the plans submitted include detailed plans for the preliminary treatment of the sewage of the village, and show location of supplementary treatment works to be constructed and put in operation whenever required or necessary. A copy of the deed of the property purchased by the village for the proposed disposal plant was submitted with the plans.

The plans have been carefully examined with respect to the sewerage system and sewage disposal works. In connection with the sewerage system the design has been carefully studied with reference to alignment, sizes, grades, capacities, durability, facilities for extension, repair, cleaning, and inspection and flushing, and other features of a hydraulic or sanitary nature. In connection with means for sewage disposal, it has been studied with reference to the present and future general method and efficiency of the sewage disposal plant as a whole, and of the capacities and practical operation of the individual structures, appurtenances, and apparatus.

The sizes of the sewers of the proposed sewer system are to vary from 8-inch to 12-inch in diameter, and are to be laid in general on slopes which appear to provide ample capacity and self-cleansing velocities under ordinary conditions. Manholes are provided at all sewer terminals, changes in direction, at sewer intersections, and at distances on straight alignment not farther apart than 500 feet on the 12-inch pipe and 400 on the smaller sizes. As surface water will naturally gravitate into the sewer trenches and often be under some ground water head, it is very essential that every precaution be taken to insure the tightness of the joints, and rigid inspection of this feature should be insisted upon before any back filling is allowed to be placed around the sewer pipes.

Only 270 house branches appear to be provided for the sewers to be constructed at first. The property frontage appears to be nearly 27,000 feet along the sewers planned for immediate installation. Unless ample branches are inserted in the sewer at the time of construction, property holders may later be seriously handicapped in making connections and the sewer itself imperiled, particularly where the property becomes closely built up and subdivided. It is, therefore, suggested that the number of house branches be materially increased.

Sewers are shown on every street, with a combined total length of about 30,475 feet. Of this length it is planned, however, to build at this time only about 14,275 feet, leaving about 16,200 feet, including 3,100 feet of outfall line, for future construction. The sizes, lengths, and location of the sewers for present and future construction are shown in the accompanying table.

The only slopes which do not seem to provide as high velocities as desirable are those on sewers planned for future construction on Washington street and Brown road, where the streets are either nearly level or graded in the opposite direction from the flow of the sewer, and are underlain with rock. It is felt that the opening up of other streets may permit more favorable grades to be secured, and that approval of plans which are represented as urgently needed, need not be withheld on this account, provided that these sewers, if built, be frequently examined and cleaned, and that flush tanks be provided at the upper ends of these sewers to facilitate cleaning and prevent stoppages.

Sewer Dimensions and Locations

LOCATION	12-inch C. I.	12-inch T. C.	10-inch T. C.	8-inch T. C.	6-inch C. I. double	Grand total	Sewers to be omitted temporarily from construction	Sewers for present construction
Disposal outfall	1,500	1,600	......	......	......	3,100	3,100	....
Storehouse alley	......	425	......	......	......	425	....	425
Basin street	......	1,025	725	925	......	2,675	600	2,075
Main street	......	......	1,425	1,925	......	3,350	1,475	1,875
Washington	......	......	750	2,725	......	3,475	2,200	1,275
Williams street	......	......	......	1,225	......	1,225	1,225	....
Franklin street	......	......	......	2,025	......	2,025	....	2,025
Rice crossing	......	......	......	775	......	775	775	....
Gould street	......	......	......	300	......	300	300	....
East St. Lawrence street	......	......	......	1,525	......	1,525	....	1,525
Mill street	......	......	......	300	......	300	300	....
Sand street	......	......	......	2,225	100	2,325	....	2,325
Brown road	......	......	......	3,175	......	3,175	3,175	....
Potter street	......	......	......	700	......	700	....	700
First street	......	......	......	525	......	525	525	....
Second street	......	......	......	525	......	525	525	....
West St. Lawrence street	......	......	......	1,650	......	1,650	1,225	425
Rice street	......	......	......	500	......	500	500	....
Third street	......	......	......	275	......	275	275	....
Pike street	......	......	......	1,125	......	1,125	....	1,125
Warren street	......	......	......	500	......	500	....	500
Totals	1,500	3,050	2,900	22,925	100	30,475	16,200	14,275

NOTE.— Except the outfall, all temporarily omitted sewers are 8 inches in diameter.

An inverted siphon of apparently appropriate design, composed of two parallel lines of 6-inch castiron pipe, is provided under the rocky bed of Phileman creek which is about 100 feet wide at the point crossed. The plan shows the minimum cover of concrete over these pipes to be 12 inches. It would seem that this minimum cover would occur where a cover of a foot or two of water might also be expected. It is, however, recommended that no less total cover be given this pipe, in which the sewage may frequently stand without flow, than would be given water pipes under similar conditions. The engineer's report states that arrangements have been made with the New York Central Railroad Company for the sewer to cross under its tracks by means of castiron pipe. Drop manholes and the proposed submerged direct outfall discharging into the river are shown in detail and appear to be of satisfactory design.

Above the point of discharge the Black river watershed has an area of about 1,900 square miles. Recorded flood discharge rates have been as high as 30,000 to 40,000 second feet. The minimum weekly discharge rate has fallen as low as about 500 second feet. The stream, however, seems to be a marked example of the benefit of storage and regulation, for in recent years the minimum flow for two days together appears seldom to average less than 1,000 second feet, and that only on Sundays during storage replenishment, while the maximum flood runoff appears to be reduced to between 15,000 and 25,000 second feet.

The disposal plant planned for future construction is shown located on a flat bluff situated on the north side of the river about 600 feet below the westerly village line and about 2,300 feet below the point of temporary discharge. The treatment plant shown by the detailed plans is to consist of a two-story settling tank. The proposed location of supplementary treatment works, consisting of contact beds followed by secondary settling tanks, is also shown on the general plans. The general elevation of the ground at the disposal plant site is about 30 feet above the level of the river, and the maximum fluctuation of the river at this point is about 7 feet, so that there is no danger that the operation of the plant will be interfered with by reason of high water.

The proposed treatment tank is planned to be constructed of concrete, and is to be 20 feet deep by 12 feet wide and 26 feet long. It is provided with plank covers and piped so as to permit of a reversal of the sewage flow and consequent better distribution of the deposit of sludge. The upper or sedimentation compartment or trough is supported by concrete beams at the third points, and is provided at the bottom with sides sloped 1¼ on 1 down to two 6-inch slots. This trough is 26 feet long by 10 feet wide and about 9 feet deep, giving a content of about 17,000 gallons, or 3 hours storage for sewage from a population of upward of 1,300 persons assuming a rate of sewage contribution of 100 gallons per capita per day. The sludge compartment below is shown provided with two hoppers, and has a content, measured 12 inches below the slots in the troughs above, of about 1,500 cubic feet, and is provided with side and center gas vents. Sludge removal is provided for by an 8-inch sludge pipe connected with each sludge-hopper. The outlet of each of these pipes is shown about 11 feet below the flow line of the tank. This is an objectionable feature, inasmuch as it would mean that the sludge bed would have to be constructed at a considerable depth below the surface of the ground in order to permit of draining the sludge pipes by gravity after each discharge of sludge. If the pipes are not drained after each discharge, the sludge running in the pipes would, in all probability, become consolidated and result in the clogging of the pipes. A head on the sludge pipe outlet of from 3½ to 4 feet would be sufficient and would permit of locating the sludge bed at a higher elevation than would be possible if the tank was constructed as planned. A perforated water pipe for forcing water under pressure into the sludge-hoppers to facilitate the removal or drawing off of the sludge should also be provided when the tank is installed.

As noted above, an application has been submitted by the board of trustees of the village under and in accordance with section 260 of the Village Law, asking for permission to omit temporarily the construction of the proposed sewage disposal plant and certain portions of the proposed sewer system. The portions of the sewer system to be constructed at first appear to cover the more developed sections of the village where the sewers are most urgently needed at present, and I do not see any objections to permitting the village to omit temporarily the construction of the remainder of the system which can be installed when required. With respect to the temporary omission of the construction of the disposal plant, I am of the opinion that the application of the village could appropriately be granted, considering the large dilution afforded by the regulated flow of the Black river at this point, the nature of the territory through which it flows, and the fact that no public water supply is derived from the river below Brownville at this time.

After a careful examination of the plans and a full consideration of the essential features of design and of the local and general requirements for sewerage and sewage disposal, I beg to recommend that these plans be approved, and a permit be issued to the board of trustees of the Village of Brownville to discharge sewage from the proposed system and disposal plant into the waters of the Black river under the following conditions:

1. That flush tanks shall be provided at the upper ends of all sewers having slopes of less than 4 per cent.
2. That the cover provided for the inverted syphon under the creek shall be sufficient to prevent its freezing and nowhere shall such cover be less than 3 feet.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewer.
4. That whenever required by the State Commissioner of Health, the proposed settling tank shall be installed and put in operation.
5. That whenever the settling tank is constructed the sludge pipes shall be so installed as to permit of draining or flushing these pipes, and perforated water pipes shall be installed in the sludge-hoppers to facilitate the removal of the sludge.
6. That whenever required satisfactory detailed plans for sludge drying bed or beds shall be submitted to and receive the approval of this De-

partment, and that such sludge drying bed or beds shall be installed simultaneously with the settling tank.

7. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment of the sewage of the village shall be submitted for approval; and upon the approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

I would further recommend that permission be granted to the board of trustees to omit temporarily the construction of the sewage disposal plant and outlying portions of the sewer system.

Respectfully submitted
THEODORE HORTON
ALBANY, N. Y., *December* 13, 1920 *Chief Engineer*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by article V of the Public Health Law, permission is hereby given to the Board of Trustees of the village of Brownville to discharge sewage temporarily from the proposed system of sewers in said village into the waters of the Black river within the municipality of Brownville, Jefferson county, N. Y., in accordance with the plans accompanying the application, under the following conditions:

1. That flush tanks shall be provided at the upper ends of all sewers having slopes of less than 4 per cent.
2. That the cover provided for the inverted siphon under the creek shall be sufficient to prevent its freezing, and nowhere shall such cover be less than 3 feet.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewer.
4. That whenever required by the State Commissioner of Health the proposed settling tank shall be installed and put in operation.
5. That whenever the settling tank is constructed the sludge pipes shall be so installed as to permit of draining or flushing these pipes, and perforated water pipes shall be installed in the sludge-hoppers to facilitate the removal of the sludge.
6. That whenever required satisfactory detailed plans for sludge drying bed or beds shall be submitted to and receive the approval of this Department and that such sludge drying bed or beds shall be installed simultaneously with the settling tank.
7. That whenever required by the State Commissioner of Health satisfactory detailed plans for additional works for more complete treatment of the sewage of the village shall be submitted for approval; and upon the approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.
Decemebr 14, 1920 *Deputy State Commissioner of Health*

CANAAN (Town) (Public School No. 1)

A sketch plan of the sewage disposal plant of Public School No. 1, in the town of Canaan, Columbia county, was approved on April 22, 1920. The disposal plant consists of a settling tank and a subsurface irrigation field apparently constructed in an artificial bed of gravel. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Trustees of School District No. 1, town of Canaan, to discharge effluent from the sewage disposal plant to serve the school in that district into the ground waters of the State tributary to Stony Kill, within the town of Canaan, Columbia county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the sewage disposal works.
4. That no sewage sludge from any part of the disposal works shall be discharged into the tributaries of Stony Kill, or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.
5. That when necessary the sludge shall be removed from the tank in such a manner as to cause no nuisance and disposed of by burying in some remote place.
6. That should it become apparent at any future time that the capacity of the filter bed or subsurface irrigation system is insufficient to care for the sewage from the school, satisfactory plans for extensions to the system shall be submitted to this Department for approval; and upon the approval of such plans the extensions shall be constructed and put in operation without delay.

M. NICOLL, JR.
April 22, 1920 *Deputy State Commissioner of Health*

CLAVERACK (Town) (States Metals Company)

Revised plans for the disposal of sewage and trade wastes of the factory of the States Metals Company, in the town of Claverack, Columbia county, were approved on September 2, 1920. The permits issued in connection with the approval of the plans follow:

PERMITS

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the States Metals Company to discharge sewage effluent from the proposed sewage disposal plant of said company at Claverack, N. Y., into the waters of Claverack creek opposite their property, within the town of Claverack, Columbia county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That the plant for the disposal of sanitary sewage shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
2. That when necessary the sludge from the proposed tanks shall be removed and disposed of in such a manner as to cause no nuisance.

3. That no sewage sludge from any part of the disposal plant shall be discharged into Claverack creek or any other watercourse or deposited on the ground where it may be washed by rain or melting snow into any watercourse.

M. NICOLL, JR.
September 2, 1920 *Acting State Commissioner of Health*

Application having been duly made to the State Commissioner of Health, as provided by section 78 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to States Metals Company to discharge effluent from the proposed treatment plant for the disposal of trade wastes from the factory of said company into the waters of Claverack creek opposite their property within the town of Claverack, Columbia county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That the plant for the disposal of trade wastes shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
2. That the wastes shall at all times be passed through all portions of the plant provided for this purpose by these plans.
3. That when necessary the sludge from the proposed tanks and beds shall be removed and disposed of in such a manner as to cause no nuisance.
4. That no sludge from any part of the disposal plant shall be discharged into Claverack creek or any other watercourse or be deposited on the ground where it may be washed by rain or melting snow into any watercourse.

M. NICOLL, JR.
September 2, 1920 *Acting State Commissioner of Health*

CLYDE

Plans for sewerage and sewage disposal for this village were approved on April 14, 1920. The report upon the examination of the plans and the permit issued in connection with their approval follow:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on the examination of plans for a proposed sewerage system and proposed sewage disposal plants for the village of Clyde, Wayne county, N. Y., submitted to this Department for approval by the engineer on behalf of the board of trustees of the village on March 24, 1920.

The village of Clyde, the population of which is estimated at about 2,700 people, is located on the Clyde river, in the southeastern part of Wayne county, 38 miles west of Syracuse. It is divided by the river into two parts, the larger section lying on the north side of the stream. The topography of the ground in the village, and particularly that in the built up sections, is flat. There are, however, a few small hills within the boundaries of the municipality. The river Clyde now forms a part of the New York State Barge canal, and in making it a part of the canal the State has raised the normal water level several feet, thus decreasing the available fall from the streets in the lower section of the village to the river and making the design of a satisfactory sewerage system more difficult.

The watershed tributary to the river above Clyde (Sodus street bridge) is, according to the reports of the State Engineer and Surveyor, 828 square miles; and the average flow of the stream at the Sodus street bridge in Clyde about 530 cubic feet per second, varying to a minimum of 250 cubic feet per second and a maximum of about 3,000 cubic feet per second. The minimum flow of the river is, therefore, equivalent to about 90 cubic feet per second per 1,000 population. No municipal water supply is taken from the river below the village of Clyde.

The plans as submitted provide for a comprehensive sewerage system for the village and for four separate sewage disposal plants for the preliminary treatment of the sewage before its discharge into the Clyde river. The plans also indicate how the sewage may at some later date be conducted to one plant and given more complete treatment by means of sprinkling filters and final sedimentation tanks.

The sewerage system as proposed will consist of about 11⅛ miles of vitrified pipe sewers varying from 6 to 18 inches in diameter. The sewers appear to be of sufficient size to care for the sewage that will reach them, although a large portion of them are smaller in size than is generally considered desirable if the sewers are to be easily maintained in proper condition; and many of the grades are, on account of the topography of the ground, necessarily very flat. Automatic flush tanks are to be provided at the upper end of all the lines for the periodic flushing of the sewers and the prevention of the accumulation of sediment which would otherwise be likely to collect on account of the flat slopes. Manholes will be provided at frequent intervals and at all changes of grade and alignment to afford access to the sewers for inspection and cleaning.

The topography of the ground in the village is such that the sewage can be most readily collected by dividing the village into five districts and draining each to a separate point. Four of these districts can be drained to the river by gravity; but the sewage from the fifth, a small section in the northwest part of the village, will have to be lifted by pumps into the sewers of one of the other districts. The northeast district, or the largest of the five, will contain about 28,000 feet of sewers which will drain to a point between the abandoned Erie canal and the New York Central Railroad tracks about 900 feet east of Glascow street. Just north of this main district is a small district containing about 2,000 feet of sewers, the sewage from which will be drained to a point on Fulton street near Lock street, where a pumping station is to be constructed to lift the sewage into the sewers of the main district. It is probable that the sewers and the pumping station to serve this district will not be built for some time. The northwest district contains about 11,250 feet of sewers which will drain to a point on the north side of the river near the foot of Sibley street. The southwest district, lying opposite to the northwest district on the south side of the river, containing about 11,200 feet of sewers, will drain to a point on the south side of the river near the end of Water street. The last district, occupying the southeast part of the village and containing about 6,500 feet of sewers, will drain to a point on the bank of the river near Meadow street. The sewage from all these districts will for the present be given preliminary treatment in plants located as follows: One at the site of the main disposal works, on the north side of the river east of the Glascow street viaduct; the second near the foot of Sibley street; the third near the west end of Water street; and the fourth between Meadow street and the south bank of the river.

The disposal plant for treating the sewage from the main or northeast district is to be located between the abandoned Erie canal and the tracks of the New York Central Railroad, about 900 feet east of the Glascow street viaduct, and will for the present consist of a plain sedimentation tank and a sludge bed. The sedimentation tank will be of concrete and covered by a one-story frame building. It will be 12 feet by 99 feet in plan and 6 feet 6 inches deep below the flow line, making its capacity about 57,500 gallons. The population of the district which will drain to this tank, estimated by the number of houses shown on the engineer's plans, is at present about 1,650 people. Assuming that all these houses will be connected to the sewers and that the flow will be about 100 gallons per capita per day, the period of detention in the tank will be approximately 8⅓ hours. According to the plans, the sewage will be discharged into a concrete trough extending across the full width of the inlet end of the tank. From this trough it will pass through a gate located at its center into the tank. It will then flow longitudinally across the tank and pass over a transverse weir extending the full width of the tank at the outlet end into an outlet channel which will discharge into a pipe leading to the river. Apparently no baffle is to be provided to prevent the escape of floating solids. The installation of such a baffle, set about 18 inches from the outlet weir and extending from about a foot above to about 2 feet below the flow line of the tank, would seem a desirable addition if the escape of the floating solids and consequent unsightly and unsatisfactory condition in the river are to be prevented. The bottom of the tank will slope toward an outlet provided in the lift valve located near one side of it at about one-third of its length from the inlet end. From this outlet a pipe will lead to a sludge well located adjacent to the tank. A 3-inch submerged vertical centrifugal pump will be installed in this well for lifting the sludge to the sludge bed.

The fact that the bottom of the tank is to have very little slope will make it necessary to empty the entire tank in order to remove the sludge. A pipe is to be provided by which the sewage can be discharged directly into the river without treatment when so desired and may be used for this purpose while the tank is being cleaned. This by-passing of the raw sewage directly into the river cannot be considered as entirely satisfactory, and the design could apparently be greatly improved and the operation of the plant made more easy by arranging the tanks so that the sludge could be drawn off from time to time without draining the tank.

The sludge bed is to be built up of 3 inches of coarse sand on 12 inches of broken stone. The walls and bottom of the bed are to be of concrete. The sludge will be applied to the bed from a concrete weir extending along one side and the effluent collected by troughs formed in the concrete bottom of the bed and protected by perforated concrete slabs. These drains or troughs will discharge into a main drain which in its turn will discharge into a pipe leading to the river. The bed, according to the engineer's report, will be 15 feet by 80 feet in plan and have an area of 1,200 square feet, the equivalent of about 0.73 square foot per capita, an area smaller than is usually considered advisable for use in connection with plain sedimentation tanks, and which will require that the plant be more carefully operated if satisfactory conditions are to be maintained.

This plant will be so arranged that its capacity may be increased when desired by the construction of additional units, and also so that sprinkling filters and secondary sedimentation tanks may be added to the plant should the more complete treatment of the sewage be required at some future date. In case such treatment is required, the sewage from the other districts will be pumped into the sewers of this district, and all the sewage of the village treated at the main disposal plant.

The Sibley street disposal plant will consist of a sedimentation tank and sludge bed similar to those proposed for the present construction at the main sewage disposal plant. The sedimentation tank will be 70 feet by 12 feet in plan and 6 feet deep below the flow line, making its capacity approximately 37,500 gallons, the equivalent of about 26 hours average flow based on a flow of 100 gallons per capita per day for the estimated population of the district. The engineer in his report, however, states that the population of this district may at some future time increase to 2,240, in which case the detention period would be reduced to 4 hours. This estimate of population seems to be a little high, and as the rate of increase in the population during the past 20 years has been very small, it is improbable that any material increase in flow will occur for many years. The sewage will enter the tank through two pipes set at about the one-third points of inlet end and at the level of the flow line, and leave over a steel outlet weir extending the full length of the tank at the outlet end. As in the case of the tank at the main disposal plant, apparently no baffle is to be provided to prevent the escape of floating solids. A sludge outlet is shown on the plans on the center line of the tank about one-third of its length from the inlet end. The pipe from this outlet will connect to a sludge well adjacent to the tank containing a submerged vertical centrifugal pump by means of which the sludge may be lifted to the sludge bed. The plans do not indicate how the normal sewage flow will be cared for while the tank is being cleaned, but it is assumed that a by-pass similar to that to be used at the main plant will be provided for this purpose. The sludge bed which is to be constructed on the same general plan as that of the one to be installed at the main disposal plant, will be 12 feet by 70 feet in plan, making its area 840 square feet, the equivalent of about 2½ square feet per capita based on the estimated present population of the district. The plant will be so arranged that should it be necessary at some future time to provide for more complete treatment of the sewage, that the tank may be easily converted into a pump well and pumps installed for lifting the sewage into the sewers of the main district.

The Water street plant will be of the same general design as the Sibley street plant except that the size of the units will be slightly different. The tank will be 45 feet by 8 feet in plan and 6 feet deep below the flow line, making its capacity approximately 16,700 gallons, or the equivalent of 10½ hours average flow based on the estimated future population. The sludge bed is to be 11 feet by 45 feet in size, making its area 495 square feet, or the equivalent of about 1.3 square feet per capita. As in the case of the Sibley street plant, the tank is so arranged that it can be converted into a pump well and pumps installed for lifting the sewage into the sewers of the southeast or Meadow street district, from which it will be lifted again, together with the sewage from that district, into the sewers of the main district.

The Meadow street plant is to be of the same type as the 2 plants just mentioned. The tank will be 25 feet by 7 feet in plan and 6 feet below the flow line, making its capacity 7,850 gallons, equivalent to about 6½ hours average flow. The sludge bed will be 10 feet by 25 feet in size and its area 250 square feet, or the equivalent of about 0.92 square feet per capita. As in the case of the Sibley and Water street plants, the tank will be so arranged that pumps may be easily installed when desired and the sewage lifted into the sewers of the main sewer district.

In view of the above, and after a careful consideration of the essential features of the design and of local and general conditions, I would recommend that the plans be approved, and a permit issued to the Board of Trustees of the village allowing the discharge of the effluent from the four proposed sewage disposal plants into the Clyde river near the plants in the municipality of Clyde. I would further recommend that in addition to the usual revocation, modification, complete construction, and storm water clauses, the permit contain the following conditions:

1. That no sludge from any part of the sewerage system or sewage treatment plants be discharged or allowed to flow into the Clyde river or any other watercourse, or deposited on the surface of the ground where it may be washed by rain or melting snow into any watercourse.
2. That the sedimentation tank be provided with suitable baffles to prevent the escape of floating solids.
3. That before any sewers are laid or the pumping station constructed in the Fulton street district, complete detailed plans for a proposed pumping station for that district shall be submitted to this Department for approval and the approval of the Department received.
4. That whenever required by the State Commissioner of Health, satisfactory detailed plans for the more complete treatment of the sewage of the village shall be submitted to this Department for approval and the approval of the Department received; and after the approval of said plans, any or all portions of the disposal plant for the more complete treatment of the sewage shall be constructed and put in operation whenever required by the State Commissioner of Health.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *April* 12, 1920

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Board of Trustees of the village of Clyde to discharge the effluents from the 4 proposed sewage disposal plants into the waters of the Clyde river near the plants within the municipality of Clyde, Wayne county, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs or other areas, shall be admitted to the proposed sewers and sewage disposal works.
4. That no sewage sludge from any part of the disposal works shall be discharged into the Clyde river, or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into the Clyde river or any other watercourse.
5. That the sedimentation tanks be provided with suitable baffles to prevent the escape of floating solids.
6. That before any sewers are laid or the pumping station constructed in the Fulton Street district, complete detailed plans for a proposed pumping station for that district shall be submitted to this Department for approval and the approval of the Department received.
7. That whenever required by the State Commissioner of Health satisfactory detailed plans for the more complete treatment of the sewage of the village shall be submitted to this Department for approval; and after the approval of said plans any or all portions of the disposal plants for the more complete treatment of the sewage shall be constructed and put in operation whenever required by the State Commissioner of Health.

M. NICOLL, JR.

April 14, 1920 *Deputy State Commissioner of Health*

COBLESKILL

Plans for a proposed sewer extension in South Washington avenue between West Main street and the proposed Riverside Drive were approved on September 2, 1920. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Sewer Commissioners of Cobleskill to discharge sewage from the sewer extension in South Washington avenue into the waters of Cobleskill creek through a temporary outfall within the municipality of Cobleskill, Schoharie county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewer extension.

2. That the sewer extension shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

3. That whenever required by the State Commissioner of Health, the sewage to be collected by the proposed sewer shall be intercepted by an intercepting sewer and conveyed to a suitable site for the disposal of the entire sewage of the village in accordance with plans which shall first be submitted to and receive the approval of this Department.

4. That whenever required by the State Commissioner of Health, satisfactory detailed plans for preliminary treatment of the entire sanitary sewage of the village of Cobleskill, accompanied by general plans for supplementary works for more complete treatment of the sewage, shall be submitted to this Department for approval; and that after the approval of said plans such works for the preliminary treatment of the sewage of the village shall be constructed and put in operation at such time or times as the State Commissioner may require.

M. NICOLL, Jr.
September 2, 1920 *Acting State Commissioner of Health*

COBLESKILL (State School of Agriculture)

Plans for a proposed sewer extension to serve the Home Economics building at the Schoharie State School of Agriculture were approved on March 26, 1920.

COLUMBUS (Town) (Phoenix Cheese Company)

Plans for the disposal of sewage and wastes from the factory of the Phenix Cheese Company, near South Edmeston, in the town of Columbus, were approved on November 11, 1920. The plans provided for some 855 feet of 15-inch tile pipe and 75 feet of castiron pipe extending from the factory to a point about midstream in the Unadilla river. The sewer is to receive the waste water and washings from the plant, the condensing and cooling water, and the sewage from the toilets. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by article V of the Public Health Law, permission is hereby given to the Phenix Cheese Company to discharge waste water and washings, cooling and condensing water, and sewage from the plant of said company, near South Edmeston, into the waters of Unadilla river within the town of Columbus, Chenango county, N. Y., in accordance with the plans accompanying the application, under the following conditions:

1. That no whey, buttermilk, or other wastes containing considerable quantities of putrescible organic matter shall be discharged into the stream.

2. That whenever required by the State Commissioner of Health, a complete separation shall be made of the unpolluted cooling and condensing water, and the waste water and washings, and the sewage from the toilets in the factory, and

3. That whenever required by the State Commissioner of Health, satisfactory detailed plans for disposal works for the treatment of the waste water and washings, and the sewage from the toilets, shall be submitted to this Department for approval; and after the approval of said plans any or all portions of such disposal works for the treatment of the waste water and washings and sewage shall be constructed and put in operation at such time as said Commissioner may designate.

4. That the intake in the Unadilla river of the auxiliary water supply for the factory of the Phenix Cheese Company be extended upstream a reasonable distance above the point of discharge of the wastes.

M. NICOLL, JR.
November 11, 1920 *Deputy State Commissioner of Health*

COMSTOCK (Great Meadow Prison)

Amended plans for a screening manhole for the sewerage system and disposal works at this institution were approved on July 27, 1920. Plans for a sewer extension to serve the Mitchell House were approved on October 6, 1920.

CORTLANDT (Town) (Baron de Hirsch Agricultural School)

Plans were approved on January 6, 1920, for sewerage and sewage disposal for the Baron de Hirsch Agricultural School, in the town of Cortlandt, Westchester county. The report upon the examination of the plans and the permit issued in connection with the approval of the plans follow:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on our examination of plans for sewerage and sewage disposal for the Baron de Hirsch Agricultural School, submitted to this Department for approval on November 25, 1919, by Mr. A. E. Hansen, consulting sanitary engineer, New York city.

The property of the Baron de Hirsch Agricultural School is located in the towns of Cortlandt and Yorktown, Westchester county, aobut 2 miles east of the village of Peekskill. This property on which the institution is located is partly on the Croton watershed of the New York city water supply and partly on the watershed of the Peekskill Hollow creek from which is derived the water supply of the village of Peekskill.

The records of this Department show that it was originally intended to locate the buildings and some of the sewers of the Baron de Hirsch Agricultural School on the watershed of a stream tributary to the Croton lake water supply of New York city. Rules and regulations for the protection of the water supply of New York city from contamination approved by this Department in 1917 require that all plans for sewage disposal plants to be constructed on the watershed from which the water supply of New York city is derived must receive the approval of the Department of Water Supply, Gas and Electricity of New York city. The proposed location of the buildings and sewage disposal plant upon the Croton watershed was opposed by the Department of Water Supply, Gas and Electricity of New York city.

It was then proposed to locate the buildings and sewage disposal plant upon the watershed from which the Peekskill water supply is derived. You took the position, therefore, that before consideration could be given to plans for sewerage and sewage disposal for this school that such plans should first receive the approval of the village authorities of Peekskill. In a letter from the Superintendent of the Board of Water Commissioners dated June 6, 1919, this Department was informed that the Board of Water Commissioners of the village of Peekskill had by resolution approved of the proposed location and system of sewage disposal to be used for the Baron de Hirsch Agricultural School, subject to the approval of this Department.

The plans now submitted for approval were prepared by Mr. Hansen, and comprise tracings and blueprints showing the proposed system of sewers and sewage disposal plant.

The report of the designing engineer submitted with the plans states that it is proposed to construct at present only part of the buildings which will ultimately be constructed for the school. The population expected at the school at present will probably not exceed 75 people, but the ultimate total population at the institution is expected to be about 200 people. It is proposed, therefore, to construct only those sewers necessary to care for the sewage of the buildings to be constructed in the immediate future. In regard to the sewage disposal plant, which is to consist of a settling tank, dosing tank, sand filters, chlorinating plant, sludge bed and sludge bed effluent filter, it is proposed to construct only 2 of the 4 sand filter units. In every other respect the sewage disposal plant to be constructed is to be adequate for the ultimate population which will contribute sewage to it.

The plans submitted for approval include sewers for the future development of the institution. These are vitrified tile sewers and are to be 6 inches and 8 inches in diameter. The 6-inch sewers are to be laid with a maximum grade of 4.31 per cent and with a minimum grade of 1 per cent, while the 8-inch sewers are to be laid with a maximum grade of 13.63 per cent and a minimum grade of 1 per cent. These grades are apparently sufficient to provide self-cleansing velocities of the sewage in the sewers under ordinary conditions, and the sewers are apparently adequate in size to care for the sewage which will be contributed to them.

Drop manholes are to be located at every change of grade and alignment in the sewers. The maximum spacing between manholes is not greater than 175 feet and the minimum spacing is about 50 feet. It would therefore appear that ample provision has been made for inspecting and cleaning the sewers.

The sewage collected by the sewerage system is to be conveyed to the sewage disposal plant through an 8-inch vitrified tile pipe sewer. The sewage disposal plant is to be located near the western boundary of the property on the watershed from which the Peekskill water supply is derived. Upon reaching the disposal plant the sewage will be discharged into a plain settling tank of the horizontal flow type. This settling tank which is to be constructed of concrete and covered by a wooden building, is to be 20 feet by 26 feet in plan with a depth ranging from 5 to 7 feet. Longitudinal concrete walls are to divide the settling tank into 4 compartments, 2 feet 3 inches, 4 feet 6 inches, 6 feet 9 inches, and 9 feet wide respectively. It is intended by this division of the tank to facilitate the use of 1/10 of the capacity of the tank and multiples thereof in order that the period of detention of the sewage in the tank may be adjusted to the increasing volume of sewage flow as the population at the school increases.

The sewage is to discharge into a concrete distributing trough from which it will flow through a single inlet to be controlled by a valve into each compartment of the tank. No baffle has been provided in front of the inlets of the settling tank and the inlets are not submerged below the level of the sewage in the tank. The sewage is to flow out of the tank through a weir into a concrete collecting channel which will convey it to a manhole from which an 8-inch vitrified tile sewer will carry it to the dosing tank.

The several compartments of the settling tank will have capacities of about 2,925 gallons, 4,050 gallons, 6,075 gallons, and 8,100 gallons respectively. Assuming a water consumption of 100 gallons per capita per day at the school, a total water consumption for the present of 7,500 gallons per day and a future water consumption of 20,000 gallons per day is obtained. On this basis, the smallest compartment of the settling tank will have an average period of detention of the sewage in the compartment of slightly more than 6 hours for the present volume of sewage flow. The total capacity of the tank is sufficient to provide a period of detention of the sewage in the tank of about 24 hours for the ultimate volume of sewage flow expected.

The bottom of the settling tank is to be sloped toward a sump at the inlet end of the tank. In this sump, sludge outlets controlled by valves are to be located in each compartment of the tank. These outlets discharge into a 10-inch castiron sludge pipe which will convey the sludge to the sludge bed. At the outlet end of each compartment at a point about 12 inches above the sloping bottom of the tank is to be located an outlet controlled by a valve. These outlets are to be used to draw off the supernatant sewage above the sludge through a 4-inch castiron pipe and discharge it into the outlet pipe to the dosing tank before removing the sludge. It would appear that if these outlets were raised some 6 inches higher above the bottom of the tank, provision would be made for a greater sludge storage capacity in the tanks.

The sludge bed is to be constructed with concrete walls and a concrete floor and is to be provided with a removable glass roof. A ventilating stack extending some 21 feet above the roof of the sludge bed is also to be provided. The filtering material of the sludge bed is to consist of 6 inches of filter bed sand having an effective size of from 0.25 millimeters to 0.35 millimeters, and a uniformity coefficient not greater than 4; 6 inches of torpedo gravel; 6 inches of ½-inch gravel; and 6 inches of ¾-inch to 1 inch gravel. The concrete floor of the sludge bed is to be sloped toward channels at each side. From the plans it would appear that these channels are to be filled with coarse gravel. The sludge bed is to be 10 feet by 17.5 feet in plan, which provides a total area of 175 square feet. The area provided should be adequate to care for the sludge from the population which will contribute sewage to the sewage disposal plant.

The underdrains of the sludge bed are to discharge on to concrete slabs in the corners of a sand filter to be constructed as a contiguous part of the sludge bed. This sand filter is to be constructed of concrete, 10 feet by 10 feet in plan, and is to contain 2 feet 3 inches of filter sand of the same specifications as those mentioned above, and 3 inches of torpedo gravel laid over an underdrain surrounded by ½-inch gravel. The bottom of the sludge bed filter is to be sloped toward the underdrain which will be located at the center of the bed, and will consist of 4-inch unglazed hexagonal tile to be laid with 1/8-inch open joints covered with strips of tar paper 2 inches wide. The effluent of the sludge bed effluent filter is to discharge through a manhole on the discharge line from the dosing tank to the sand filter. As the effluent from the sludge bed is to be discharged on to the sand filters, it would appear unnecessary to filter the effluent before it is discharged on to them.

The sludge after drying on the sludge bed is to be buried in trenches which are to be located at such a point that no direct surface water wash can carry the sludge into a watercourse.

From the manhole at the settling tank the sewage is to flow through an 8-inch sewer to the dosing tank, which is to be constructed of concrete with a concrete roof containing a manhole and cover. The dosing tank is to be 16 feet by 16 feet in plan and is to have a maximum depth of 2 feet 11 inches below the level of the sewage at which the siphon will discharge. A capacity of about 5,000 gallons has therefore been provided in the dosing chamber, which will cause the siphon to discharge at the rate of about once a day for the present flow of 7,500 gallons per day, and about 4 times per day for the future volume of sewage flow of 20,000 gallons per day.

The dosing tank is to contain a single 8-inch Miller siphon having a rate discharging capacity of 2.12 cubic feet per second. The dosing tank will therefore be discharged in about 5 minutes. One complete discharge of the dosing tank will theoretically cover 1 sand filter unit to a depth slightly greater than 2 inches.

From the dosing tank the sewage will be discharged through a 12-inch castiron main distributing sewer through a diverting chamber onto either of 2 sand filter units. The sand filters to care for the ultimate volume of sewage flow are to consist of 4 units, and provisions have been made to distribute the sewage on these beds when they are built. The future sand filters are shown on the plans at present submitted for approval and are to be similar in area and construction to those to be built at present. The distribution of the sewage on to either of the sand filter units is to be manually controlled. It would appear that more positive results would be obtained and more uniform alternation of the discharge of the effluent from the settling tank on to the sand filter units effected if plural alternating siphons and the necessary additional distribution piping were installed to distribute the effluent on to the filter.

The sewage is to be discharged onto the sand filter units by means of distributing troughs having concrete bottoms and wooden sides. These troughs are to be provided with adjustable gates spaced at intervals of 12 feet. The sand filter units are to be constructed by excavation and embankment and are to consist of 3 feet of filter sand to have an effective size of from 0.25 to 0.35 millimeters, and a uniformity coefficient less than 4; 3 inches of torpedo gravel; 3 inches of ½ inch to ¾ inch gravel; and from 0 to 6 inches of 1 inch to 1½ inch gravel to be laid over the underdrains. The floor of each filter is to be sloped toward the underdrains which are to consist of 6-inch drain tile placed 12 feet 1½ inches apart on centers with a grade of about 1.16 per cent. These underdrains will discharge into 8-inch main collectors which will convey the sewage to a 12-inch sewer to the chlorinating building.

Each of the 2 filter units is to be 55 feet by 55 feet in area. A total area of about .138 acre has therefore been provided for the present volume of sewage flow, and of about .276 acre for the ultimate volume of sewage flow. These areas are sufficient to provide a rate of application of the sewage to the sand filters of about 54,000 gallons per acre per day at present and of about 72,000 gallons per acre per day in the future.

The sand filter effluent is to be conducted to the chlorinating building, which is to consist of a concrete detention chamber covered by a small building in which will be housed duplicate solution feed chlorinators. In this building will also be located a scales and a stove. The detention chamber is to be divided into 2 chambers by a transverse concrete wall. The combined capacity of these 2 chambers will be about 1,500 gallons, which for the volume of sewage flow expected at present will provide an average period of detention of the sewage in the chamber of slightly more than 4 hours and an average period of detention of slightly more than 1 hour for the ultimate volume of sewage flow.

The sewage is to enter the first compartment of the detention chamber through an elbow extending downward, and the chlorine is to be applied to the sewage as it flows downward through this elbow into the detention chamber. The rate of application of the chlorine to the sewage is not stated in the report submitted by the designing engineer with the plans. As the effluent from this disposal plant is to be discharged into a watercourse from which is derived a public water supply, it is important that the effluent be effectively chlorinated at all times, and a uniform rate of application of the chlorine to the sewage treated of not less than 5 parts of chlorine per million parts of sewage should be used.

From the chlorinating building the effluent is to flow through an 8-inch castiron outfall sewer a distance of about 150 feet to a small watercourse. It appears from the plans that this watercourse is to be obstructed above the point of discharge of the effluent from the filter plant into it by the construction of the sand filters, and that there will be very little runoff tributary to this stream. The report of the designing engineer states that this stream bed is tributary to Gregory Pond at a distance of about 1,000 feet below the point of discharge of the disposal plant effluent into it. This report states further that the stream bed loses its pronounced character on the slope leading to the pond, and it is expected that the effluent will be distributed over the ground surface and be absorbed by the ground during the greater part of the year.

In view of the results of our examination of these plans, and after a careful consideration of the essential features of the design and of local and general requirements with respect to the proper methods for the disposal of sewage from the proposed sewerage system and sewage disposal plant of the Baron de Hirsch Agricultural School, I beg to recommend that these plans be approved. I further recommend that a permit be granted for the discharge of sewage effluent from the proposed sewage disposal works into a tributary of the Peekskill Hollow creek, in the town of Cortlandt, Westchester county, on the following conditions:

1. That a uniform rate of application of the chlorine to the effluent of the sand filters of not less than 5 parts of chlorine per million parts of sewage treated shall be maintained at all times.

2. That no sewage sludge from any part of the disposal plant shall be discharged into Peekskill Hollow creek, its tributaries, or any other watercourse, or be deposited upon the surface of the ground at such a

point that it may be washed by rain or melting snow into Peekskill Hollow creek or any other watercourse.

3. That whenever the sewage tributary to the proposed disposal plant shall exceed that contributed by 75 persons, sand filter units Nos. 1 and 4 shall be constructed and put in operation.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *December* 11, 1919

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Baron de Hirsch Fund to discharge effluent from the proposed plant to serve the Baron de Hirsch Agricultural School near Peekskill, N. Y., into the waters of a tributary to Peekskill Hollow creek within the town of Cortlandt, Westchester county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That a uniform rate of application of the chlorine to the effluent of the sand filters of not less than 5 parts of chlorine per million parts of sewage treated shall be maintained at all times.
5. That no sewage sludge from any part of the disposal plant shall be discharged into Peekskill Hollow creek, its tributaries, or any other watercourse, or be deposited upon the surface of the ground at such a point that it may be washed by rain or melting snow into Peekskill Hollow creek or any other watercourse.
4. That whenever the sewage tributary to the proposed disposal plant shall exceed that contributed by 75 persons, sand filter units Nos. 1 and 4 shall be constructed and put in operation.
7. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal plant.

M. NICOLL, JR.
Deputy State Commissioner of Health

January 6, 1920

EASTHAMPTON (Town) (Fisheries Products Company)

Plans for the disposal of wastes from the fish factory of the Fisheries Products Company, at Promised Land, in the town of Easthampton, were approved on May 22, 1920. The report on the examination of the plans and the permit issued in connection with the approval of the plans follow:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on the examination of plans for the disposal of the wastes from the Fisheries Products Company's fish factory at Promised Land, town of Easthampton, Suffolk county, N. Y., submitted to this Department for approval by the company on May 6, 1920.

The fish factory of the Fisheries Products Company is located on the south shore of Gardiner's bay, about 2 miles east of the unincorporated village of Amagansett. The land in the vicinity is in general waste land, either bare or covered with brush and scrub oaks and pines. The only dwellings in the vicinity are a few large summer residences, apparently recently constructed, located on high ground a little over a mile west of the factory. Another smaller fish factory known as the Triton plant is located immediately west of the Fisheries Products Company's plant.

The factories manufacture fish oil from manhaden fish and produce a scrap which is used as a base for the manufacture of fertilizer. The capacity of the Fisheries Products Company's factory is such that it can handle from 8,000 to 10,000 barrels of fish per day. About 600 men and a fleet of 17 boats are engaged during the season from June to October in obtaining fish for the plant, and from 250 to 325 men are employed at the factory.

The fishing boats are brought along side of a pier extending about 300 feet out into the bay, and the fish lifted from the boats by 1 of 2 chain and bucket elevators to hoppers discharging on to a conveyor running longitudinally along the center of the pier above the fish pen, a bin about 200 feet long and 20 feet wide having a capacity of approximately 12,000 barrels of fish. Gates are provided in the conveyor trough to allow the discharge of the fish into any part of the pen. Below the bin a second longitudinal conveyor is arranged to take the fish to the cooker and press house located immediately back of the pier. Openings with removable covers are provided in the bottom of the bin by means of which the fish may be dropped on to this conveyor

At the cooker and press house the fish are fed into 2 cylindrical horizontal cookers arranged to cook the fish by steam. Helical conveyors carry the fish through the cookers and discharge them into a bin at the lower end of a bucket conveyor which lifts them into a hopper discharging on to a conveyor leading to a battery of 6 presses.

These presses are of the screw type. Each consists of a horizontal circular cage made up of iron bars set far enough apart to allow the passage of the oil between them and to retain most of the flesh of the fish. The cage being slightly smaller at the outlet end than at the inlet, the fish are compressed as the screw forces them through the press: the oil, together with a certain amount of slime, blood, and small particles of flesh, escaping between the openings of the slats, and the larger part of the flesh being discharged from the press at the outlet end. The oil and other liquids are collected by shallow tanks or hoppers below the presses and conducted by troughs to the oil recovery tanks. The flesh or scrap falls into a helical conveyor which is arranged to discharge on to a conveyor leading to the scrap pile, or on to one leading along the pier adjacent to the one just mentioned, by means of which the scrap may be discharged directly into boats. This latter conveyor was being reconstructed at the time of the inspection of the plant on May 17, 1920, and it was stated that it is the intention of the owners to transfer the scrap directly from the presses to the boats whenever possible. Facilities are provided for treating the scrap with sulphuric acid as it passes to the scrap pile or to the boats. It is understood that this treatment fixes the phosphates and renders the scrap more valuable as a fertilizer base. The treatment also acts to some extent to prevent the putrefaction of the scrap.

The oil recovery tanks which receive the oil and other liquids from the presses are arranged to operate in series. The first 2 tanks act to a certain extent as sedimentation tanks, and are arranged so that the fine scrap which escapes from the presses with the oil and other liquids can be discharged into a bin on the floor below and lifted by a bucket conveyor to the presses where it is repressed. The tanks are provided with steam pipes, baffles, and skimming devices for separating and skimming off the oil. The oil from these tanks after cooling is pumped to storage tanks located about a quarter of a mile east of the plant and stored there until shipped. The gurry from the oil recovery tanks is pumped to a filter house near the oil storage tanks and there mixed with sawdust and shavings and pressed to recover the oil in it. The cakes of sawdust and gurry after pressing have no value and are piled outside of the press house. It is said that these cakes give off no odors.

The other liquids from the oil recovery tanks are discharged into a concrete tank known as the fish water tank. This tank is 123 feet by 31 feet by 8 feet in size and has a capacity of about 200,000 gallons, the equivalent of about 5 times the estimated flow of fish water from the oil recovery tanks. From this tank the liquid is pumped to a battery of 4 steam heated vacuum evaporators. The vapor from these evaporators is said to contain no oil and is condensed in jet condensers and discharged into the bay. The semi-viscous mass known as gurry stick left in the evaporators is discharged into a covered concrete tank about 24 feet by 35 feet by 9 feet in size from which it is from time to time transferred to the scrap pile. No exact information is available as to the capacity of the evaporators. It is stated by the owners of the factory that the evaporators will care for the average daily flow of fish water from the tanks just mentioned and those on the wharf described below; but they are apparently not capable of evaporating the water at the maximum rate of flow, and on account of frequent breakdowns cannot always care for the average flow. There is room in the evaporator house for the installation of additional evaporators, but it is stated by the owners of the factory that it is impossible to secure the delivery, within a year, of the only type of evaporator suitable for the work.

Due to the handling of the fish, a considerable quantity of oil, slime, blood, etc., drains from the fish on the conveyors and in the bin. This liquid is collected by troughs below the conveyors and bin and conducted to oil recovery tanks on the wharf similar to those just described. The oil from these tanks is pumped to the oil storage tanks the same as that from the oil recovery tanks at the press house. The gurry and fish water from these tanks have been, however, discharged directly into the bay.

As pointed out in our report of September 16, 1919, the factory at present is faulty in construction and has in the past been improperly maintained and operated and an objectionable and serious nuisance was created during the summer of 1919, due to the breeding of flies, the emanation of objectionable odors, and the discharge of oil, gurry, and other wastes into the bay. It was recommended in this report of September 16, 1919, that all the conveyors, tanks, and vats be made water-tight, and that all liquid wastes now discharged into the bay be collected to one point where they may be disposed of either by evaporation or some other suitable means; that all scrap be shipped away as fast as possible; and that all parts of the premises where flies may breed be sprinkled with a suitable disinfectant at regular and frequent intervals.

The plans now submitted contemplate certain alterations and additions to the plant to improve its sanitary condition.

In order to prevent the direct discharge into the bay of the offal falling on the deck of the pier, a 3-inch reinforced concrete slab, covering an area of about 315 by 45 feet in size, will be constructed under the fish bin and conveyors on the wharf. This slab will be graded toward the center and 2½-inch drains spaced 50 feet apart will be provided to discharge the matter collecting on the slab floor together with the water used for cleaning it into troughs to be constructed under the pier. These troughs will lead to a timber sedimentation tank which will also receive the deck washings and bilge from the boats. There is nothing on the plans or in the engineer's report to indicate the size and slope of the troughs below the deck of the wharf nor how they will be kept free from obstructions. This would seem to be an important matter, since any stoppage of these troughs would allow the wastes to overflow the sides of the troughs and fall directly into the bay. In order to prevent such occurrences the troughs should be carefully graded, and suitable manholes arranged at frequent intervals should be provided in the deck over them to permit access for inspection and cleaning. The sedimentation tank is to be located under the deck of the wharf on the west side, and will be 16 feet by 12 feet in plan and 10 feet deep, making its capacity about 2,000 cubic feet, or 15,000 gallons. The tank is to be divided into three compartments by a transverse weir extending from the bottom to within about 2 feet of the flow line at a point 6 feet from the inlet end of the tank, and a baffle extending from the top to about 18 inches of the bottom at a point 3 feet from the outlet end of the tank. Since there is no available data as to the quantity of wastes that will reach this tank, the detention period, the velocity of flow, and the probable quantity of solids that will collect in the tank cannot be accurately estimated. The wastes will enter the first compartment of the tank at the center of one end through an 8-inch castiron pipe which will extend to a point about 18 inches above the bottom, pass out of the first compartment over the weir into the second compartment, and then out of the second under the baffle into the third compartment, and finally out of the tank through a standpipe overflow near the center of the outlet end. Three trap doors, each about 24 inches square, are to be provided in the dock of the wharf over the tank to afford access for inspection and cleaning. It is understood that any oil collecting on the surface will be skimmed off and taken to oil recovery tanks, and that the sediment will be dipped out when necessary and carried to the scrap pile.

The fish water from the oil recovery tanks at the press house and on the wharf, and some bilge water from the boats, amounting in all, according to the report of the designing engineer, to about 80,000 gallons per day, will be conducted to the fish water tank which is to be remodeled. This tank when modified will consist of a concrete structure about 121 by 31 feet in plan and 7 feet deep covered with a corrugated metal roof. The tank will be divided into three compartments by a concrete partition wall extending longitudinally through the center of the tank from one end to within about 10 feet of the opposite end, and 2 transverse partitions, 1 extending from the center wall to the north wall about 45 feet from the west end of the tank and the other from the center wall to the south wall at the end of the center wall and about 10 feet from the east end of the tank. The transverse walls will be only 4½ feet high and will therefore act as weirs. The 3 compartments, which will operate in series, will therefore have capacities of about 60,000 gallons, 45,000 gallons, and 23,000 gallons, a total of 128,000 gallons when filled to the level of the tops of the transverse partition or weirs. If, however, the tank is filled to its high water line, it will contain approximately 150,000 gallons. With the estimated average flow of fish water the first compartment will hold about 18 hours average flow before the liquid overflows into the second compartment, and the entire tank about 48 hours flow before the liquid will overflow to the cinder screens described below. Each of the compartments of the tank is to be provided with a transverse wooden baffle extending from the top to a point 18 inches above the bottom. The baffle in the first compartment is to be located near the center of the compartment, that in the second about two-thirds of the distance from the inlet to the outlet end, and that in the third about 10 feet from the outlet end or three-quarters of the distance from the inlet to the outlet end of the compartment.

Under normal conditions the fish water from the oil recovery tanks will be discharged into the first compartment of the fish water tank, and pumped from there to the evaporators through a 3-inch pipe connected to the inlet end of the tank. Should, however, the evaporators break down, or for any reason be unable to handle the flow of fish water, the liquid will overflow into the second compartment and then into the third, and finally make its escape through the outlet to the cinder screens.

These cinder screens will consist of five beds of coarse, four beds of medium, and five beds of fine cinders, each 7 by 9 feet in plan and 5 feet deep, provided with concrete walls and floors, and be grouped in two rows forming a structure about 68 by 16 feet in plan. The beds are to be connected to operate in series. The wastes from the fish water tank will be discharged onto the first coarse bed, pass down through that bed and up through a rectangular outlet box extending from about 18 inches above the bottom of the bed to the top of the next bed, then in the same manner through each of the beds in turn. The outlet from the last of the beds will discharge into an 8-inch pipe leading to the bay. The level of the liquid on the filters will be about 6 inches above the top of the cinders. A total loss of head of only 0.4 of a foot is allowed for from the inlet to the outlet of the series Perforated steam pipes will be provided in the beds to assist in separating any oil which may be carried to them with the fish water. According to the statements of the designing engineer, any oil which accumulates on the surface of the liquid on the cinder beds will be skimmed off and taken to the oil recovery tanks, and the cinders when they become clogged will be removed and taken to the scrap pile and new cinders placed in the bed.

It is intended that the cinder screens will be used only when the evaporators fail or are unable to handle the total flow. If, however, the entire estimated flow of 80,000 gallons per day should reach the filters, the rate of filtration in each bed will be about 55,000,000 gallons per acre per day, or 0.85 of a gallon per square foot per minute. There is no data available from which the probable loss of head through the filters and the time during which they will operate before clogging can be accurately estimated. The rate of filtration given above is several times as great as has ever been attempted with domestic sewage, and it seems probable that unless the cinders are very clean and coarse that there will be considerable loss of head and that clogging will take place in a very short time.

There will be very little domestic sewage discharged from the factory. Earth vault privies and privies projecting out from the edge of the wharf are provided for the men working at the plant. In the owners' cottage, however, there is a bathroom with three fixtures, and in the office building one toilet and one lavatory. In addition to these, there is of course the waste from the sinks in the kitchen of the mess hall. All of this sewage is at present discharged directly into the bay.

It is now proposed to construct a settling tank about 50 feet above the high water line of the bay to treat the wastes from the kitchen and office building, which are located not far apart, and to discharge the effluent from the tank into the bay through a 4-inch outlet extending 100 feet beyond the low water mark. The proposed settling tank, which is intended to act also as a grease trap will be a covered concrete structure 17 feet 6 inches by 6 feet in plan and 4 feet deep below the flow line, making its capacity about 3,000 gallons. The tank will be divided into 3 compartments by 2 transverse walls or weirs, 1 located 4 feet from the inlet and the other located 4 feet from the outlet end extending from the bottom of the tank to the flow line. The middle compartment is divided at its center by a transverse wooden baffle extending from the under side of the roof to a point 12 inches above the floor of the tank. The inlet and outlet of the tank consist of Ts, with one branch of each extending about 3 feet below the surface of the liquid. Two manholes will be provided to afford access to the tank for inspection and cleaning. The sewage from the owners' cottage is to be disposed of in a leaching cesspool about 6 feet in diameter and 6 feet deep located near the cottage.

In view of the above facts, and after careful consideration of the essential features of the design and of local and general conditions, I would recommend that the plans be approved, and a permit issued to the Fisheries Products Company allowing the discharge of the effluents from the proposed works to treat the trade wastes and domestic sewage from their factory into the waters of Gardiner's bay, and the ground waters of the State tributary to Gardiner's bay, at the points indicated on the plans on the property of the Fisheries Products Company, in the town of East Hampton, Suffolk county, N. Y., subject to the following conditions:

1. That all the proposed improvements for bettering the sanitary conditions at the fish factory, including pavements, drains, troughs, sewers, sewage and waste disposal works and their appurtenances shown by the plans approved this day, shall be fully constructed in complete conformity with such plans or approved amendments thereof except where variations are expressly required by the conditions of this permit, and the work completed before the fish factory is put in operation.

2. That no oil, gurry, stick, filter press wastes, or scrap shall be discharged or thrown or allowed to flow or fall into Gardiner's bay or any tributary thereof, or deposited on the ground where it may be washed into Gardiner's bay or any tributary thereof: and that no water or liquid which has drained from or come in contact with any fish, oil,

gurry, scrap, or which contains any oil, blood, slime, gurry, scrap, sewage from toilets, sinks, lavatories or showers, or other putrescible matter shall be discharged or allowed to flow into Gardiner's bay or any tributary thereof, or onto the ground where it may flow into Gardiner's bay or any tributary thereof, except through the outlets shown on the plans approved this day.

3. That the evaporators used for evaporating the fish water be maintained in proper working condition at all times, and that should it be found that the present evaporators have not sufficient capacity to dispose of all the fish water, except such small quantities as for short periods may be taken care of by the cinder screens, additional evaporators be installed with as little delay as possible.

4. That the cinder screens be used only in case of emergency and to treat such small quantities of water as the evaporators may for short periods at times of maximum flow be unable to dispose of, and that the cinders be removed and disposed of in such a manner as to create no nuisance and replaced with new cinders whenever the beds become clogged.

5. That should the cinder screens prove to have insufficient capacity properly to care for the tank effluent reaching them, the beds be remodeled and enlarged without delay in accordance with plans satisfactory to this Department, or a sufficient number additional evaporators installed to reduce the quantity of liquid reaching the cinder screens to an amount that can be satisfactorily treated by them.

6. That the troughs and pipes leading to the settling tank under the wharf be properly graded to carry the water reaching them without danger of stoppages, and that suitable manholes be provided at frequent intervals in the deck of the wharf over the troughs to afford access to them for inspection and cleaning.

7. That whenever necessary to prevent the escape of sediment or scum from the settling tanks on shore or on the wharf, the sediment or scum shall be removed by a suitable method and disposed of by placing on the scrap or in some other satisfactory manner.

8. That only sanitary or domestic sewage and no trade waste, storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal plant and cesspool intended for the treatment of domestic sewage.

9. That when necessary the sludge from the proposed tank and cesspool for the treatment of the domestic or sanitary sewage shall be removed in such a manner as to cause no nuisance, and finally disposed of by burying in some remote place.

Respectfully submitted

THEODORE HORTON

ALBANY, N. Y., *May* 21, 1920 *Chief Engineer*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by sections 76, 78, 79 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to The Fisheries Products Company to discharge the effluents from the proposed works to treat the trade wastes and domestic sewage from their factory into the waters of Gardiner's bay and the ground waters of the State tributary to Gardiner's bay, at the points indicated on the plans on the property of the Fisheries Products Company, within the town of East Hampton, Suffolk county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That all the proposed improvements for bettering the sanitary conditions at the fish factory, including pavements, drains, troughs, sewers, sewage and waste disposal works and their appurtenances shown by the plans approved this day, shall be fully constructed in complete conformity with such plans or approved amendments thereof, except where variations are expressly required by the conditions of this permit, and the work completed before the fish factory is put in operation.

4. That no oil, gurry, stick, filter press wastes, or scrap shall be discharged or thrown or allowed to flow or fall into Gardiner's bay or any tributary thereof, or deposited on the ground where it may be washed into Gardiner's bay or any tributary thereof; and that no water or liquid which has drained from or come in contact with any fish, oil, gurry, scrap, or which contains any oil, blood, slime, gurry, scrap, sewage from toilets, sinks, lavatories, or showers or other putrescrible matter shall be discharged or allowed to flow into Gardiner's bay or any tributary thereof, or on to the ground where it may flow into Gardiner's bay or any tributary thereof, except through the outlets shown on the plans approved this day.

5. That the evaporators used for evaporating the fish water be maintained in proper working condition at all times, and that should it be found that the present evaporators have not sufficient capacity to dispose of all the fish water, except such small quantities as for short periods may be taken care of by the cinder screens, additional evaporators be installed with as little delay as possible.

6. That the cinder screens be used only in case of emergency and to treat such small quantities of water as the evaporators may for short periods at times of maximum flow be unable to dispose of, and that the cinders be removed and disposed of in such a manner as to create no nuisance and replaced with new cinders whenever the beds become clogged.

7. That should the cinder screens prove to have insufficient capacity properly to care for the tank effluent reaching them, the beds be remodeled and enlarged without delay in accordance with plans satisfactory to this Department, or a sufficient number additional evaporators installed to reduce the quantity of liquid reaching the cinder screens to an amount that can be satisfactorily treated by them.

8. That the troughs and pipes leading to the settling tank under the wharf be properly graded to carry the water reaching them without danger of stoppages, aind that suitable manholes be proivded at frequent intervals in the deck of the wharf over the troughs to afford access to them for inspection and cleaning.

9. That whenever necessary to prevent the escape of sediment or scum from the settling tanks on shore or on the wharf, the sediment or scum shall be removed by a suitable method and disposed of by placing on the scrap or in some other satisfactory manner.

10. That only sanitary or domestic sewage and no trade waste, storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal plant and cesspool intended for the treatment of domestic sewage.

11. That when necessary the sludge from the proposed tank and cesspool for the treatment of the domestic or sanitary sewage shall be removed in such a manner as to cause no nuisance, and finally disposed of by burying in some remote place.

M. NICOLL, Jr.

May 22, 1920 *Deputy State Commissioner of Health*

EAST ROCHESTER

Plans were approved on August 18, 1920, for proposed amendments to the East Rochester sanitary sewer system on Elm, McKinley, Grant, South Washington, and Commercial streets, and on a private right of way between Commercial street and East avenue, in the village of East Rochester. The permit issued in connection with the approval of the plans contained only the usual complete construction and storm water clauses.

GHENT (Town) (District School No. 3)

Plans were approved on May 20, 1920, for the disposal of sewage from the public school in School District No. 3, of the town of Ghent, Columbia county. The disposal plant, according to the plans, is to consist of a settling tank and subsurface irrigation field located on the school property. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Trustees of School District No. 3, town of Ghent, to discharge the effluent from the proposed sewage disposal plant to serve the school in said district into the ground waters of this State tributary to Kline Kill, within the town of Ghent, Columbia county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal works.
5. That when necessary the sludge shall be removed from the proposed tank in such a manner as to cause no nuisance, and disposed of by burying in some remote place.
6. That no sewage sludge from any part of the disposal works shall be discharged into Kline Kill, or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.
7. That the joints in the drain tile in the subsurface irrigation field be properly protected by tar paper and broken stone or gravel so as to prevent the entrance of sand or loam into the tile and to allow the sewage to pass freely to the soil.
8. That should at any time, due to the increase in the attendance at the school or other cause, the length of tile in the subsurface irrigation field be found insufficient satisfactorily to care for the sewage from the school, additional tile shall be added to the field.

M. NICOLL, JR.

May 20, 1920 *Deputy State Commissioner of Health*

GREENPORT (Town) (District School No. 1)

Plans for the disposal of sewage from District School No. 1, at Greenport Center, in the town of Greenport, were submitted for approval on September 30, 1920. These plans were returned for revision on October 14, 1920, and the revised plans were approved on October 19, 1920. The plans provided for a disposal plant consisting of a settling tank and a line of field tile connected to a leaching cesspool. The permit issued in connection with the approval of these plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Trustees, School District No. 1, town of Greenport, to discharge effluent from the proposed disposal plant of the school in Greenport Center into the ground waters tributary to the Hudson river, in accordance with the plans accompanying the petition, under the following conditions:

1. That the sewer and disposal plant shown by the plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
2. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewer and sewage disposal works.
3. That no sewage sludge from any part of the disposal works shall be discharged into the tributary of the Hudson river, or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.
4. That when necessary and not less frequently than once a year the sludge shall be removed from the proposed tank in such a manner as to cause no nuisance, and disposed of by burying in some remote place.
5. That whenever required by the State Commissioner of Health, satisfactory detailed plans for extension of the proposed system or plans for additional works for treatment of the sewage for the school shall be submitted for approval; and upon the approval of said plans any or all portions of such extension or additional works for treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.

October 19, 1920 *Acting State Commissioner of Health*

HAMBURG

Amended plans for a sewerage system and sewage disposal plant for the village of Hamburg were approved on December 6, 1910. The plans provided for a comprehensive sewerage system and a sewage disposal plant consisting of a settling tank, sprinkling filter, chlorination plant, and final settling tank. The plans also provided for pumping the sewage from about one-half of the village. The above plans were revised and amended and approved by this Department on February 23, 1920. The revised and amended plans contemplated the construction of the sewage disposal plant at a new site and a rearrangement of lines and grades of the sewers to conduct the sewage to the new location. The rearrangement eliminated the main pumping station. The sewage disposal plant remained practically the same as in the original plans. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Trustees of the village of Hamburg to discharge effluent from the sewage disposal works to be constructed in connection with the proposed sewer system for the village into the waters of Eighteen Mile creek near the proposed disposal works, within the town of Hamburg, Erie county, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof, except as otherwise required by this permit.
4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers and sewage disposal works.
5. That no sewage sludge from any part of the disposal works shall be discharged into Eighteen Mile creek or its tributaries, or be deposited upon the ground, where it may be washed by rain or melting snow into Eighteen Mile creek or any other watercourse.
6. That if difficulty is encountered in the proper chlorination of the effluent from the sprinkling filters, the chlorine shall be applied to the effluent from the secondary settling tank.
7. That each unit of the proposed sewage pumping station on Buffalo street shall have a capacity of not less than 50 gallons per minute, and that a duplicate source of power shall be provided for operating the ejectors.
8. That complete detailed plans and specifications for the proposed sewage pumping station shall be submitted to and approved by this Department before the plant is constructed.

M. NICOLL, JR.
February 23, 1920 *Deputy State Commissioner of Health*

Plans were approved on July 1, 1920, for sewer extensions in the village of Hamburg on Crescent avenue and Buffalo street, and for an ejector station to take care of these low lines. The permit issued in connection with the approval of these plans contained, in addition to the usual storm water and complete construction clauses, the following condition:

That the ejector be built and provided for operation in duplicate, and that a manhole be built near the middle of the 600 foot length shown between manholes through private rights of way below Buffalo street.

HAMBURG (Town) (Erie County Agricultural Society)

Plans for the treatment and disposal of sewage from the fair grounds of the Erie County Agricultural Society, in the town of Hamburg, were submitted for approval on August 30, 1920. The plans provided for two separate disposal plants, each consisting of a settling tank and an apparatus for the sterilization of the effluent with hypochlorite of lime. The plans were returned to the designing engineer for certain modifications. The plans were revised in general accordance with the suggestions of the Department, and were approved on September 23, 1920. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Erie County Agricultural Society to discharge effluent from the proposed sewage disposal plants to be installed to care for the sewage from the comfort stations at the fair grounds of said society in the town of Hamburg into the waters of a tributary of Rush creek at the point of discharge shown by the plans, within the town of Hamburg, in accordance with the plans accompanying the petition, under the following conditions:

1. That the settling tanks shall be cleaned annually, and that the sludge shall be buried or such disposition made of it as to avoid the creation of any nuisance or menace to health.
2. That no sludge from the settling tanks shall be discharged into Rush creek or any other body of water, or deposited on the ground where it might be washed thereinto by rain or melting snow.
3. That a constant head orifice box be installed, or that the location of the control valve be lowered to a point not more than 6 inches above the ground level, in order that a more uniform application of the solution of hypochlorite of lime may be effected.
4. That on or before June 1, 1921, satisfactory detailed plans for additional works for more complete treatment of the sewage from the fair grounds, such as by sand filtration, shall be submitted for approval; and after the approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation when required by the State Commissioner of Health.

M. NICOLL, JR.
September 23, 1920 *Acting State Commissioner of Health*

HAVERSTRAW (Town) (Letchworth Village)

Plans were approved on May 20, 1920, for proposed sewer extensions to serve the Girls' Group at Letchworth village, Thiells. The plans were submitted for approval by the State Architect. No permit was issued in connection with their approval.

HEMPSTEAD (Town) (District School No. 22)

Plans were approved on November 27, 1920, for a proposed sewage disposal plant for the school in School District No. 22, at Floral Park, in the town of Hempstead. The plans provided for the treatment of the sewage in a disposal plant consisting of a sedimentation tank and a series of leaching cesspools. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by article V of the Public Health Law, permission is hereby given to the Board of Education of School District No. 22, of the town of Hempstead, to discharge effluent from the proposed system of leaching cesspools to serve the school in the village of Floral Park, into the ground waters tributary to the Atlantic ocean, within the town of Hempstead, Nassau county, N. Y., in accordance with the plans accompanying the application, under the following conditions:

1. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
2. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal works.
3. That no sewage sludge from any part of the disposal works shall be discharged into Simonson Pond brook or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.
4. That when necessary, and not less frequently than once a year, the sludge shall be removed from the proposed tank in such a manner as to cause no nuisance, and disposed of by burying in some remote place.
5. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional series of cesspools or works for the treatment of the sewage for the school shall be submitted for approval; and upon the approval of said plans any or all portions of such additional works for the treatment of the sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.

November 27, 1920 *Deputy State Commissioner of Health*

JOHNSON CITY

Plans were approved on June 22, 1920, for sewer extensions in Massachusetts avenue, Cook street, Crocker avenue, Main street terrace, Cleveland and Endicott avenues, and Broad street, in the village of Johnson City. On November 24, 1920, plans were approved for sewer extensions in Bernice, Brown, Burns, Carlton, Olive, Sturtevant, and Thomas streets, and Grand avenue, in the village of Johnson City. The permits issued in connection with the approval of these plans follow:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Trustees of the village of Johnson City to discharge sewage from the proposed sewer extensions in Massachusetts avenue, Cook street, Crocker avenue, Main street terrace, Cleveland and Endicott avenues and Broad street, into the waters of the Susquehanna river through the present outfall sewer at the Delaware, Lackawanna and Western Railroad bridge, within the town of Union, Broome county, N. Y., in accordance with the plans accompanying the petition under the following conditions:

1. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewer extensions.
2. That a manhole be constructed at once to or near the surface of the ground, where a manhole foundation is shown on the plans, immediately below the creek crossing on Broad street.

3. That all the work shown on the plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof, except as to condition 2 above.

4. That whenever required by the State Commissioner of Health, the sewage to be collected by the proposed sewers shall be conveyed to and treated in sewage disposal works to be constructed jointly by the village of Johnson City and the city of Binghamton, or by the village of Johnson City alone, to care for the entire sewage of the village, under plans to be submitted to and approved by this Department.

M. NICOLL, JR.

June 22, 1920 *Deputy State Commissioner of Health*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by article V of the Public Health Law, permission is hereby given to the Board of Trustees of the village of Johnson City to discharge sewage through the proposed sewer extensions in Bernice, Brown, Burns, Carlton, Olive, Sturtevant, and Thomas streets and Grand avenue, in the village of Johnson City, into the waters of the Susquehanna River through the present outfall sewer at the Delaware, Lackawanna and Western Railroad bridge. within the town of Union, Broome county, N. Y., in accordance with the plans accompanying the application, under the following conditions:

1. That the iron pipe sewer crossing of the open ditch on Burns street be either so arranged that the pipe will be enveloped in and rigidly supported by properly reinforced concrete and so that it will not materially reduce the carrying capacity of the drainage ditch; or that it be so arranged as to pass beneath this ditch in an inverted siphon and provided with additional manholes at each end just above and below the ditch.

2. That the elbow at the lower end of the descending inflow pipe at the drop manhole be either surrounded by the masonry of the manhole or be made of iron resting upon the manhole base extended.

3. That the sewer extensions shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof with the exception of the two above conditions.

4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewer extensions.

5. That whenever required by the State Commissioner of Health, the sewage to be collected by the proposed sewers shall be conveyed to and treated in sewage disposal works to be constructed jointly by the village of Johnson City and the city of Binghamton, or by the village of Johnson City alone, to care for the entire sewage of the village, under plans to be submitted to and approved by this Department.

M. NICOLL, JR.

November 24, 1920 *Deputy State Commissioner of Health*

LAKE PLACID

Plans were approved on January 26, 1920, for a sewer in Main street, in the village of Lake Placid. The permit issued in connection with the approval of the plans contained only the usual revocation, modification, complete construction, and storm water clauses.

LARCHMONT

Plans for sewer extensions in Ocean and Linden avenues, in the village of Larchmont, were approved on April 19, 1920. The permit issued in connection with the approval of the plans contained, in addition to the usual revocation, modification, complete construction, and storm water clauses, the following condition:

That whenever required by the State Commissioner of Health, the sewage disposal plants for the treatment of the sewage of the village shall be constructed in accordance with the plans approved by this Department on March 2, 1917, and the provisions of the permit issued on the same date in connection with the approval of the plans, and in accordance with plans subsequently approved and permits subsequently issued by this Department.

LIBERTY (Town) (Loomis Sanatorium)

Revised plans for a sewerage system and sewage disposal plant to serve the Loomis Sanatorium, in the town of Liberty, Sullivan county, were approved on March 12, 1920. The report upon the examination of the plans and the permit issued in connection with the approval of the plans follow:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on the examination of revised plans for a sewerage system and sewage disposal plant to serve the Loomis Sanatorium, in the town of Liberty, Sullivan county, N. Y., submitted to this Department for approval by the designing engineers on March 9, 1920.

The Loomis Sanatorium, an institution for the treatment of tuberculosis, is located about three miles west of the village of Liberty, and occupies about thirty buildings scattered over a large area sloping to the south and toward Swan lake. According to the report of the designing engineers, the total population of the institution at the present time is 335, but in designing the sewage disposal plant the engineers have provided for a population of 400.

The sanatorium is at present served by three separate sewage disposal plants which are not giving entirely satisfactory results. A description of these plants will be found in a report on the water supply and sewage disposal of the institution submitted to you under date of June 18, 1919. Plans for a sewerage system and sewage disposal plant to serve the entire institution were submitted to this Department for approval on November 7, 1919. These plans were examined, and a report recommending that certain modifications be made in the design was submitted to you under date of November 21, 1919. The plans have been revised in general accordance with these recommendations and have now been resubmitted to this Department for approval. These revised plans contemplate the construction of a sewerage system for collecting the sewage from all the institution buildings that are equipped with plumbing fixtures, and a sewage disposal plant, consisting of a settling tank, sludge bed, dosing chamber, and intermittent sand filters for treating the sewage so collected.

The sewerage system will consist of a trunk sewer about 4,940 feet long, comprising 360 feet of 4-inch pipe, 3,955 feet of 6-inch pipe, and 325 feet of 8-inch pipe, and a number of laterals or house sewers. The larger part of the trunk line, which lies above the waterworks of the institution, is to be of castiron pipe laid with lead joints in order to prevent the possible contamination of the water supply by leakage from the sewers. The grades will in general be sufficiently steep to produce satisfactory self-cleansing velocities if the sewers are properly laid, the minimum grade being 2 per cent. The average depth of the trunk line will be about 6 feet. Manholes are to be provided at frequent intervals and at all changes in grade and alignment except at stations Nos. 10 and 19, where changes in grade are indicated between manholes. This undesirable condition can apparently be easily corrected at station No. 10 by relocating the manhole and connecting line just below this point, and at station No. 19 by straightening the grade, which will involve only a slightly deeper cut for a short distance. Unless some conditions exist that are not shown on the plans, this should be done.

Twenty-eight buildings will be connected to the trunk line by lateral sewers consisting largely of lines of 4-inch castiron pipe. Two lateral lines, both of which are below the waterworks, are to be of 6-inch tile pipe. The grades of the laterals are not given in detail, but judging from the slope of the ground will apparently be satisfactory. The lines should have a slope of not less than 2 per cent.

The settling tank is to be a concrete structure covered with a one-story frame building. It will be divided by a longitudinal concrete partition into two separate compartments each 10 feet by 34 feet in plan and 10 feet 6 inches deep from the flow line to the bottom of the hopper bottom. The capacity of each compartment will be 19,000 gallons, making the total capacity of the tank 38,000 gallons, the equivalent of about 25 hours average flow based on a population of 400 and an assumed sewage flow of 100 gallons per capita per day. Transverse masonry walls will be built across each compartment of the tank at its middle. The lower half (3 feet) of this wall will be of open brickwork to allow the liquid to pass from the first into the second section formed by the transverse wall. An 8-inch circular overflow will be provided through the wall above the flow line. One hopper, the flattest side of which has a slope of 6 on 10, forms the bottom of each section. A diverting manhole fitted with shear gates will be provided just outside of the inlet end of the tank arranged so that sewage may be admitted to either or both of the compartments of the tank.

The sewage will enter the tank through 8-inch Ts extending 3 feet below the flow line of the tank and located at the center of the inlet ends of the compartments, pass under concrete baffles set 6 feet from the inlet end, and extending from 6 inches above to 4 feet 6 inches below the flow line; then through the open parts of the transverse partitions which extend from 3 feet below the surface to the top of the hopper bottoms, which are 6 feet below the surface; then through the second sections of the compartments and under concrete baffles similar to those near the inlet ends set 5 feet from the outlet ends, and out of the tank through 8-inch Ts at the centers of the outlet ends of the compartments. The function of the transverse partitions is not entirely apparent; and while they will probably have little effect on the operation of the tank, their construction seems unnecessary. The baffles are to be placed farther from the ends of the tank than is usually customary, and would probably serve their purpose better if placed nearer the end walls of the tank. The outlet pipes of the two compartments of the tank join in a Y a few feet beyond the outlet end of the tank. The grade of the pipes to this Y is not definitely indicated, but should be sufficiently steep to prevent the sewage from flowing from one tank to the other should the level in one tank be drawn down.

Six-inch sludge draw-off pipes will be provided, connected to the bottom of each hopper for discharging the sludge onto the sludge beds. The outlet branches of these pipes will be 3½ feet below the normal level of the liquid in the tank, and the fall from the tank to the sludge beds which are located 120 feet from the tank will be 11 feet.

The sludge beds will be two in number, each 15 feet by 20 feet in plan, making their total area 600 square feet, or the equivalent of 1.5 square feet per capita, an area which is somewhat less than is usually considered advisable for use in connection with tanks of the type proposed, and which will require that the sludge be drawn off frequently and the beds well taken care of if satisfactory results are to be obtained. The beds are to be made of 4 inches of sand placed on a layer of broken stone varying from 6 inches to 12 inches in depth. The sludge will be discharged on to the beds through two 6-inch valves, one located at a corner of each bed. The plans do not indicate that any means will be provided to prevent the incoming sludge from washing away the sand near the inlets and finding its way directly into the broken stone and underdrains. It would seem desirable that some means, such as the construction of aprons under the inlets, should be provided to prevent this. The sides of the beds are planked to a height of 8 inches above the surface of the filter. The effluent from the beds will be collected by 4-inch tile underdrains 10 feet on centers, and conducted to a main 4-inch drain which will carry it to the dosing chamber of the sand beds.

The dosing chamber is to be a concrete tank 16 by 16 in plan and will be covered with a one-story brick house. The depth of the tank below the water line will be 3 feet, making its available capacity 5,700 gallons, the equivalent of about 3.4 hours average flow or a depth of about 1⅛ inches on one sand bed. The chamber is to be equipped with four automatic siphons arranged to discharge the contents of the dosing chamber onto each of the four sand beds in turn, making the average time between dosings on each bed about 14 hours. The size of the siphons is not given, but according to the scale is about 6 inches. In order effectively to flood beds of the size proposed, the siphon discharges should be at the rate of approximately 730 gallons per minute. With an average head of about 21 inches as provided in this case, this would require 8-inch siphons.

The sand beds, four in number, are each to be 90 feet by 90 feet in plan, making the total filter area 32,400 square feet, or approximately 0.75 of an acre. With the estimated population of 400, and an assumed sewage flow of 100 gallons per capita per day, the rate of filtration will be 53,300 gallons per acre per day. The beds will be made of 3 feet of sand and placed on 6 inches of medium broken stone, which in turn will rest upon a layer of larger broken stones varying from 0 to 6 inches in depth. The size and character of the sand is not given. To assure satisfactory results the sand should have an effective size of not less than 0.2 millimenter, nor greater than 0.45 millimeter, preferably about 0.3 millimeter and should be free from clay, loam, or material likely to decompose. The uniformity coefficient should be less than 5. Three parallel wooden troughs 6 by 8 inches in size, provided with 1-inch holes 4 feet apart along each side, will be placed on each bed about 30 feet apart, for distributing the sewage. Four-inch tile drains, 18 feet on centers, laid in the coarse broken stone under the beds will be provided for collecting the effluent and conducting it to the 8-inch main effluent pipe. This pipe discharges on the property of the sanatorium into a small stream tributary to Swan lake, at a point about 2½ miles from the lake. The outlet of this lake is Mangaup river, which flows in a southerly direction about 25 miles and empties into the Delaware river. There is no water supply taken from Mangaup river below the point of discharge of the sewage effluent.

In view of the results of our examination of these plans, and after a careful consideration of the essential features of the design and of local and general conditions, I would recommend that the plans be approved, and a permit issued to the Loomis Sanatorium allowing the discharge of the effluent from the proposed sewage disposal plant to serve the sanatorium, into a tributary of Mangaup river on the property of the sanatorium, in the town of Liberty. I would further recommend that in addition to the usual revocation, modification, complete construction, and storm water clauses, the permit contain the following conditions:

1. That there shall be no change in grade or alignment between the manholes on the trunk sewer.
2. That the dosing tank siphons shall be not less than 8 inches in size.
3. That the sand used in the construction of the filter beds shall be clean, free from loam, clay, or readily decomposable matter, and shall have an effective size of not less than 0.2 m.m or more than .45 m.m., and a uniformity coefficient of not more than 5.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *March* 11, 1920

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the

Loomis Sanatorium, town of Liberty, to discharge the effluent from the proposed sewage disposal plant to serve the sanatorium into a tributary of Mangaup river on the property of the sanatorium, within the town of Liberty, Sullivan county, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal works.
5. That no sewage sludge from any part of the disposal works shall be discharged into any tributary of Mangaup river or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.
6. That there shall be no change in grade or alignment between the manholes on the trunk sewer.
7. That the dosing tank siphons shall be not less than 8 inches in size.
8. That the sand used in the construction of the filter beds shall be clean, free from loam, clay, or readily decomposable matter, and shall have an effective size of not less than 0.2 millimeter or more than .45 millimeter, and a uniformity coefficient of not more than 5.

M. NICOLL, JR.

March 12, 1920 *Deputy State Commissioner of Health*

Amended plans for the proposed sewage disposal plant to serve Loomis Sanatorium were approved on April 8, 1920. The plans proposed to substitute a two-story settling tank for the plain settling tanks, and left the sewerage system and the remainder of the sewage disposal plant as shown on the original plans. The sewage disposal plant as provided for by the new plans will consist of a two-story settling tank, sludge beds, and intermittent sand filters. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Loomis Sanatorium, town of Liberty, to discharge the effluent from the proposed sewage disposal plant to serve the sanatorium into a tributary of Mangaup river on the property of the sanatorium within the town of Liberty, Sullivan county, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal works.

5. That no sewage sludge from any part of the disposal works shall be discharged into any tributary of Mangaup river or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.

6. That there shall be no change in grade or alignment between the manholes on the trunk sewer.

7. That the dosing tank siphons shall be not less than 8 inches in size.

8. That the sand used in the construction of the filter beds shall be clean, free from loam, clay, or readily decomposable matter, and shall have an effective size of not less than 0.2 millimeter or more than .45 millimeter, and a uniformity coefficient of not more than 5.

M. NICOLL, JR.
April 8, 1920 *Deputy State Commissioner of Health*

MAMARONECK (Town) (Sewer District No. 1)

Plans were approved on July 15, 1920, for a sewer system for Sewer District No. 1, in the town of Mamaroneck, Westchester county. The report upon the examination of the plans, together with the permit issued in connection with their approval, follow:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on the examination of general plans for sewerage for Sewer District No. 1, in the town of Mamaroneck, Westchester county, N. Y., submitted by the board of sewer commissioners to this Department for approval on June 15, 1920, together with the report of the designing engineer and the application for a permit. A field inspection of this district was made by an engineer of the Department on June 20, 1920, and additional information was submitted by the engineer of the district, at the request of the Department, on June 30, 1920.

Sewer District No. 1 of Mamaroneck has an area of 356 acres, and lies in the southwestern part of the town, and with its western boundary forming a common boundary with that of the city of New Rochelle. In general outline the form of the district resembles an inverted letter Y, with the stem pointing slightly west of north, and with the village of Larchmont reaching up between the branches and separating their lower extremities from Long Island sound. The upper or northerly section is very hilly and wooded. The east section is suitable for a closer development, but much of the southerly section is low and less desirable for settlement, so that while the present population of under 600 was found to be greatly in need of sewers, provisions for an ultimate population greater than say 7,000, or 20 persons per acre, seems unnecessary.

The records of this Department show that on March 2, 1917, plans for a disposal plant for the village of Larchment were approved, and the plans now submitted show that it is intended to discharge the sewage tributary to this proposed sewerage system through the present and proposed system of sewers of Larchmont and through this disposal plant. However, a proposed preliminary treatment is indicated by locations being shown for two Imhoff tanks in residential sections of Mamaroneck — one above the railroad, and another on the Larchmont village line near the houses of the growing settlement in that village along Forrest Park avenue. From letters of the engineer dated June 9, 26, and 29, 1920, and the engineer's report of June 10. 1918, submitted with the plans, it appears that before the construction of the sewers on any particular street or series of streets the engineer will make the usual large scale plan and profiles of the particular work contemplated and submit the same to the Department for approval, and that where sewers are shown through private land the intention is to acquire rights of way 10 feet or more in width. The last letter of the designing engineer referred to gives a few essential cuts, diameters, and grades which were requested by the Department since they were not shown on the plan. The engineer's letters and report also state that the board of trustees of Larchmont village, who have had joint meetings with the board of sewer commissioners of District No. 1 of Mamaroneck, insisted on Imhoff tanks being provided by this district on each of the two principal incoming sewers from Sewer District No. 1 of the town of Mamaroneck.

The attitude of the Department on this matter was referred to in a previous report, and it should not be difficult for the parties concerned to make a prompt and equitable agreement for the logical plan of treatment of the sewage of the town sewer district and the Bonnett avenue sewer district at one point instead of ineffective and uneconomical duplication of sewage disposal plants. If the sewage from the town sewer district were treated at the points indicated by the plans, the partially treated sewage would be immediately mixed with the raw untreated sewage of the village when discharged into the Larchmont sewers. Furthermore, such partial treatment of the sewage of the town would not materially affect the efficiency or the size of the Bonnett avenue plant for the joint treatment of the sewage from the town and village districts tributary to it, and the cost of construction and maintenance of three plants would be much greater than the construction and up-keep of one joint treatment plant near the harbor as originally planned. I am of the opinion, therefore, that permission should not be granted to the sewer commissioners of Sewer District No. 1 of the town of Mamaroneck to treat the sewage from this sewer district in individual sewage disposal plants before such sewage is discharged into the Larchmont sewer system.

The connections between the sewers of District No. 1 of Mamaroneck and those of Larchmont are made at three points. The sewage from about 290 acres is to cross the town line in an 18-inch pipe on a 0.25 per cent grade under the railroad on the line of Cedar street, Mamaroneck, prolonged; the sewage from about 58 acres is to cross the town line in a 10-inch pipe on an 0.5 per cent grade on the line of Forrest avenue, Larchmont, prolonged; and the sewage from about 5 acres on the north side of the Post road, and from about 3 acres on the south side of the Post road, in 8-inch pipes on 0.5 per cent grades. These sewers give a total combined outlet capacity sufficient for several times the ultimate population to be expected in the district.

The principal or 18-inch connection between the town and the village is shown on the approved village maps and mentioned in report on proposed sewers for Larchmont of April 4, 1918, and is also shown and described on a map attached to a plan for sewer extensions in Larchmont approved by this Department December 4, 1919. It has a capacity of about 5 second feet, indicative of a preparation on the part of the village to receive from the town a flow from a population of some 15,000 persons. Therefore it is apparent that this Department as well as the village and town authorities continuously held in mind a connection of sufficient magnitude to embrace the territory now occupied by under 600 persons with an ultimate population of but about one-half that for which preparations have been arranged for in advance.

The sewage from the entire sewer district, except from a small area in the southwesterly portion of the district marked I-A.M.L., naturally drains toward the village of Larchmont, and as noted is to be discharged by gravity flow into the trunk sewer of the so called Bonnett avenue sewer district of the village of Larchmont. The sewage from district I-A.M.L. is to be collected at a pumping station near the lower end of Fifth avenue, from which it is to be pumped into the gravity system at the intersection of Murray avenue and Beech street. Detailed plans of the pumping station and force main of this district have not been prepared or submitted, as it is expected by the sewer commissioners that it will be a considerable time before this area will be developed and require sewers. Before the pumping station and force main are installed, however, satisfactory detailed plans for these structures should first be submitted to and receive the approval of this Department.

The plans of the proposed sewer system now submitted comprise a general plan in duplicate, but it is not accompanied by profiles, and no drainage lines or contours are given to facilitate the examination of the plans. The plan shows an area about 1,400 feet by 2,800 feet in transverse diameters without elevations. The field inspection showed the feasibility of sewering this area into the proposed system and revealed the nature of the territory. It, however, also brought to light that while the legend on the plan showed that dotted lines were to be used to indicate ungraded streets, many streets shown in solid lines had no existence on the ground.

The entire system of sewers shown are 8-inch and of suitable larger diameters up to 18-inch. They are designed with slopes that will give self-cleansing velocities if properly constructed. Flush tanks are shown at their dead ends, and manholes at angles and throughout at intermediate points at distances of about 300 feet apart. All points, including the lowest points in the area of the district where no sewers are shown, are so situated and of sufficient elevation to permit their being reached by gravity extensions from the proposed system.

After a careful examination of the plan and report submitted, and a full consideration of the local aspects on the ground and of the features of design, I would recommend that the plans be approved, and a permit be issued to the sewer commissioners of Sewer District No. 1 of the town of Mamaroneck allowing the discharge of sewage from the sewer district into Larchmont Harbor, through the outlet sewer of Sewer District No. 1 of the village of Larchmont. I would further recommend that the permit contain the following conditions

1. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewer and disposal works.
2. That before any sewers are constructed in Sewer District No. 1 of the town of Mamaroneck, a copy of the agreement between the board of trustees of the village of Larchmont and the sewer commissioners of said sewer district, for the joint treatment of the sewage of Sewer District No. 1 of the town of Mamaroneck and the sewage of the village of Larchmont tributary to the Bonnett avenue outfall sewer, shall be submitted to this Department.
3. That before the pumping station and force main for subdistrict I-A.M.L. are constructed, detailed plans for said pumping station and force main shall be submitted to and receive the approval of this Department.
4. That before any of the sewers not shown in detail by the approved plans are constructed, satisfactory detailed plans of said sewers shall be submitted to and receive the approval of this Department.
5. That whenever required by the State Commissioner of Health, the sewage to be collected by the proposed sewers of this sewer district shall be passed through the Bonnett avenue sewage disposal plant of the village of Larchmont, which plant shall be constructed and put in operation whenever required by said Commissioner.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *July* 14, 1920

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the sewer commissioners of Sewer District No. 1 of the town of Mamaroneck to discharge sewage from this sewer district into the waters of Larchmont Harbor through the outlet sewer of Sewer District No. 1 of the village of Larchmont, within the village of Larchmont, Westchester county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers.
2. That before any sewers are constructed in Sewer District No. 1 of the town of Mamaroneck, a copy of the agreement between the board of trustees of the village of Larchmont and the sewer commissioners of said sewer district for the joint treatment of the sewage of Sewer District No. 1 of the town of Mamaroneck and the sewage of the village of Larchmont tributary to the Bonnett avenue outfall sewer, shall be submitted to this Department.
3. That before the pumping station and force main for subdistrict I-A.M.L. are constructed, detailed plans for said pumping station and force main shall be submitted to and receive the approval of this Department.
4. That before any of the sewers not shown in detail by the approved plans are constructed, satisfactory detailed plans of said sewers shall be submitted to and receive the approval of this Department.
5. That whenever required by the State Commissioner of Health, the sewage to be collected by the proposed sewers of this sewer district shall be passed through the Bonnett avenue sewage disposal plant of the village of Larchmont, which plant shall be constructed and put in operation whenever required by said Commissioner, or that said sewage shall be intercepted by intercepting sewers and treated in sewage disposal works to be constructed by Sewer District No. 1 of the town of Mamaroneck in accordance with plans which shall first be submitted to and approved by the State Commissioner of Health.
6. That no sewage disposal works shall be installed at the points indicated by the approved plans without the approval of this Department.

M. NICOLL, JR.
July 15, 1920 *Deputy State Commissioner of Health*

MARCY (Town) (Utica State Hospital)

On August 9, 1920, plans for water supply distribution system and sewerage and sewage disposal systems for the Marcy Division of the Utica State Hospital were approved. The report upon the examination of the plans for sewerage and sewage disposal follows, in part:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on the examination of Specification No. 2387, and Drawings Nos. 2089 to 2096, inclusive, and Drawing No. 1058, covering sewerage and sewage disposal systems for the Marcy Division of the Utica State Hospital, in the town of Marcy, Oneida county, N. Y., submitted to this Department for approval by the State Architect on July 10, 1920.

Previous Sewer and Disposal Plans

The records of the Department show that on July 22, 1917, preliminary plans for the collection and disposal of the sewage of this hospital were approved on the condition that final and detailed plans were to be presented before the construction of the work. These original plans provided for an immediate population of 3,000 persons and an ultimate population of 5,000. It was later decided to modify the original plans, and in this connection several conferences were held with the representatives of the State Architect by the engineers of this Department between October 2, 1918, and April 9, 1920, inclusive, in which details of a plant smaller in both the present and future capacity were gone into at considerable length.

State Architect's Report

The letter from the State Architect submitting the present plans and specifications states that the Marcy Division of the Utica State Hospital is to be a hospital for the insane; that it is now under construction, contracts for the four buildings for immediate installation having been let; and that sewer and water connections are shown for two other buildings, which buildings are shown but are not to be built at present. The letter further states that two of the four buildings planned for immediate construction are to be chronic patient buildings, and are designed to care for approximately 300 inmates each. Another one of these four buildings is to be an acute patients building, and is designed to care for approximately 200 inmates. The total population which will be cared for in the buildings now under contract is stated to be less than 1,000, and the estimated ultimate population of the institution when completed at some future date in accordance with present plans is stated to be approximately 3,000.

General Location

The property of the State upon which this proposed hospital is located lies about 5 miles by rail west of Utica, between the Mohawk river on the southwest and the Rome, Watertown and Ogdensburg Railroad on the northeast. The property is nearly rectangular in general form with sides about 1½ miles in length. It slopes rapidly up a 100-foot rise from elevation of about 440 feet above mean sea level, along the Barge canal, which lies between the property and the Mohawk river, and then slopes more gently back across a highway which runs in general parallel to the canal and the railroad, to where nearly a mile beyond the highway the property reaches a summit elevation of about 630 feet.

Buildings Served

The power house of the institution shown by the plans, and which comprises the fourth building under construction, is located on a railroad spur where the side of the short slope toward the railroad levels out about 400 feet from the railroad station. The building for acute patients is about one-half mile, measured at right angles to the railroad, back from the depot, and nearly as far from the highway mentioned which traversed the other side of the property above the crest of the slope near the canal. The two buildings for chronic patients are symmetrically placed on each side of a line between the first two buildings, and distant about 1,000 feet from each other and from the building for acute patients.

Sewerage and Sewage Disposal

The plans for sewerage and sewage disposal have been carefully examined with respect to the sewer system and sewage disposal works. In connection with the sewerage system, the design has been carefully studied with reference to alignment, sizes, grades, capacities, facilities for cleaning and inspection, and other features of a hydraulic or sanitary nature. In connection with means for sewage disposal, it has been studied with reference to general method and efficiency of the sewage disposal plant as a whole, and of the capacities, and practical construction and operation of the individual structures, appurtenances, and apparatus, and suitability of the point of discharge.

Sewerage System

The sanitary sewage is all collected and flows to and through the disposal works by gravity, except the sewage from the power house and two or three adjacent buildings, which sewage it is planned to pump at the power house up over the ridge where it enters into the gravity system at its nearest but highest point. The outfall sewer is 15-inches in diameter and about ¾ of a mile long, extending to the disposal plant at the foot of the bank above the canal about 900 feet from the road and 700 feet from the nearest house.

The sewage pump well and pumping equipment is shown on the plans for the new heating and lighting plant for the institution, and is located near the middle of the northerly side of this building which is nearly 300 feet long. The bottom of both the receiving well and dry pump well are 16 feet below ground floor level and 6 feet below the level of the motor room floor. Two horsepower induction motors are provided with automatic float and switch starters, and appear ample to operate the pumps at the specified 200 gallon per minute rate against a 40-foot head. The 3-inch direct connected centrifugal pumps which lift the sewage through 600 feet of 6-inch castiron force main are protected by a removable bar screen of 2-inch by ¼-inch bars 1 inch apart placed in the receiving well. The pumps are to have a maximum static suction head of 2 feet and a static discharge head of 30 feet.

The receiving well is located just outside the wall line of the building and is constructed of concrete, as is also the pump well. The sanitary sewage from the building itself, as well as from a proposed incoming 6-inch sewer from the mortuary shops and cottages, which is not shown in detail, are to be discharged into the receiving well, which extends up to the level of the ground floor of the building. The building sewer enters the receiving well at about elevation 601, while that from the cottages enters about elevations 592, though the nearest future building shown is 550 feet away and has a ground elevation of 600, so that it would appear that this intake might be raised several feet if basement fixtures were omitted.

The scaled horizontal dimensions of the pump well are approximately 5½ by 8 feet, giving it a capacity of 330 gallons per foot of depth. Therefore the effective receiving well capacity seems to be sufficient for the service now planned. The well floor is but 2.58 feet on the average below the incoming cottage sewer mentioned, which leaves a useful capacity of 850 gallons.

Sewer Details

In detail, the sanitary sewers gradually increase in size from 6 inches to 15 inches as they descend toward the canal without reduction at any point and appear to be of ample capacity to prevent undue clogging and to permit the passage of sewage. The slopes are not shown at all, and the sizes are not given on the profiles, but the computation from the elevations shown at manholes indicates that all the sanitary sewers have been given sufficient slopes to produce self-cleasing velocities. All sewers are of vitrified pipe. except the 600 foot 6-inch force main delivering sanitary sewage from the power house, and about an equal length of 12-inch effluent pipe from the disposal plant to the canal, which are to be of castiron.

The alignments of the sewers are chosen with a view to minimizing the cuts, which vary between 4 feet and 17 feet. It is recommended that, particularly at great depths, tight joints be insisted on, and that under such ground water and earth pressures particular attention be given to solidifying the supporting backfill beneath and beside the pipes.

Sewer Appurtenances and Features

Manholes are to be placed at each point of change in direction in line, and at distances not greater than 400 feet apart. The only unusual features in the system are the submerged effluent discharge pipe, which in some ways resembles an inverted siphon; frequent 6-inch and 8-inch plugged openings or sleeves provided for future connections at manholes, for the many future buildings shown on them in faint outline; and the systems being so planned that all the sanitary sewage from these buildings can drain by gravity into the present system.

A commendable feature of the specifications is the requirements that a trial run of a week's duration shall precede acceptance of the sewer system and disposal plant from the contractor.

Treatment and Disposal

The sewage disposal plant for the treatment of sanitary sewage of the institution is to consist of screening chambers in duplicate, preliminary settling tanks of the two-story type in duplicate, dosing tank and apparatus, sprinkling filter, final settling tank, and chlorination building and apparatus, with auxiliary beds for the treatment of sludge. The effluent from this plant is planned to be discharged into the canal through about 600 feet of 12-inch pipe at a point approximately 1,200 feet northwesterly from the Crane Creek canal spillway, and about 1,800 feet from the highway traversing the property.

Effluent Dilution

The portion of the canal into which the effluent is to be discharged is fed by waters from wide adjoining slopes, and more largely by water from Nine Mile, West Canada, and Marcy or Crane creeks, the Mohawk river, the Black River canal, and old Erie canal feeders, in all about 10 or 15 comparatively adjacent sources. It thus affords ample dilution of the effluent, is of exceptionally dependable volume and uniformity of flow, and is moreover relatively free from danger of back water obstruction. In addition, it has the further advantage of not being used adjacently or elsewhere below to any considerable extent as a source of public water supply. It is, however, occasionally used above for the disposal of sewage and trade waste directly or indirectly, as from Rome, and from the Fibre Company at Hinckley, and from sanitary wastes entering it through its feeders.

Disposal Plant Site

The site chosen for the disposal plant is where abundant fall is available, between contours 440 and 470 on the lower portion of the slope above the canal and about midway between the latter and the highway. Ample suitable land for expansion is available on all sides. While the plans show 6 or more buildings, apparently houses, adjoining the highway within 1,000 feet or less of the plant, the nearest is about 800 feet distant. This house is, besides, 60 feet higher in elevation and back from the brow of the hill, and above the point where the road turns southward and descends the latter. This turn in the road brings one or more of the houses on it and the road itself seemingly more within sight of the disposal plant. On this account it is suggested that the placement of some screen, of not too close or dense a nature as of trees, on the southeasterly side of the plant and between it and the canal, might be considered, holding in mind the avoidance of any restriction of possibilities for future extension.

Character and Amount of Sewage

No trade waste and no rain water or drainage, but only sanitary sewage from the hospital buildings and their toilets, kitchens, laundries, etc., are carried by the sewers for treatment in the disposal plant. The sanitary sewage will reach the disposal plant in general in an exceptionally fresh state, none, with the exception of a small portion to be pumped from the power house, being over one hour old. The amount of sanitary sewage to be provided for from all the buildings now under contract for construction is that from 1,000 persons, or an average flow of 100,000 gallons per day. A maximum hourly rate of flow of 251 gallons per capita per day, giving a maximum rate of 215,000 gallons per day, or ⅓ second foot, for very short periods during certain days, may be anticipated to obtain at institutions such as that at Marcy.

Disposal Works Details

The outfall sewer discharges into the screen chamber which adjoins the primary settling tanks. This chamber is supported by a 12 inch reinforced concrete slab, and is subdivided by 12 inch concrete walls into a distribution manhole and duplicate screen chambers. It is about 7 feet wide by 11 feet long and 4 feet deep in gross interior dimensions, with a hydraulic depth of 1.08 feet and gross combined sewage capacity of 500 gallons. The impounding of the water in this manhole and these tanks to a depth of 1.08 feet gives the incoming sewage a hydraulic cross section of 4.32 square feet, which for an average flow of 100,000 gallons per day gives a velocity of but ⅛ of the previous self-cleansing velocity in the pipe.

This check in velocity will lead to the rapid formation of deposits. Ordinarily a hopper bottom drained through a valve and pipe on a steep slope to a suitable filter might seem desirable; but it is understood that in an institution of this character daily or frequent hand cleaning and consequent examination is desirable and assured. In construction in placing the screen and embedding any frame of the hinged doors, it is particularly recommended that nothing be left which will obstruct a smooth continuous raking surface from the bottom of the screen up on to the top of the screen chamber.

Primary Tanks

The primary settling tanks, which are to be of the two-story type, are to be of reinforced concrete. Each tank is to be 14 feet wide by 29 feet 4 inches long, with a maximum hydraulic depth of 24 feet 6 inches and a total depth of 28 feet. The side walls are 1 foot 4 inches in thickness, but the hopper bottoms, which may be subjected during construction or later to reversed and unequal stress, are but 6 inches thick, and reinforced against external pressure or flotation only by but 4 per cent volume, or 0.9 pound per square foot, of fabric reinforcement. While it is believed these bottoms may not leak or give trouble, yet the construction of them between 20 and 30 feet below ground surface seems to contrast with the heavily reinforced walls of the upper partition walls where pressure from both sides is equal and uniform.

Sewage is admitted in one end of the primary settling tanks and passes out from the other over the level edges of reinforced concrete gutters on each end, which are protected from scum by a 2 foot 3 inch reinforced concrete baffle 4 inches thick extending 1 foot above water surface. Each primary settling tank has a total capacity of over 50,000 gallons. Of this the inner or upper chamber contains 20,000 gallons. This upper chamber is 10 feet wide by 12 feet 6 inches deep below the water line, and slopes 1½ on 1 to a 6 inch slot at the bottom, which has a lip so projecting as to prevent the entrance of any bubbles or rising particles from the under tank. The capacity of the upper tanks provides a seemingly satisfactory settlement or subsidence detention period. With one tank in use, this would be 5 hours for 100,000 gallons a day, or, with both tanks in operation, of between 3 and 4 hours for a rate of 300,000 gallons a day.

Sludge Tanks

The available combined sludge storage space of both tanks, measured beneath a plane taken 1 foot below the bottom of the slot, is about 40,000 gallons, or about 13 gallons per capita for a population of 3,000, which appears sufficient. Lead pipes for facilitating sludge removal are shown, but no water supply for the plant appears to be provided. The mains of the institution water supply should be extended to the disposal plant, or an independent water supply should be provided for use at the disposal plant.

Siphon Chamber

The siphon chamber is of concrete adjoining the ends of the settling tank. It is 10 feet long by 5 feet wide with the two end walls sloping to the bottom, which is 5 feet square and 6 feet below the water surface. This chamber is to be provided with a 12 inch automatic siphon which is to discharge the contents of the tank in doses of about 2,000 gallons to the sprinkling filters through a 14 inch main castiron distributing pipe, the volume depending on the inflow during siphonage and whether one or both tanks are connected. The siphon chamber is provided with a drain, and is so arranged as to receive the effluent from either or both tanks. It is made accessible by hinged wrought-iron doors placed on the top 3 feet 6 inches above the water level. A 12 inch by-pass is to be provided around the dosing tanks from each preliminary settling tank. These by-passes are to be connected with the main distribution of the sprinkling filter, and it is assumed that they are to be used only in case of emergency.

Sprinkling Filter

The sprinkling filter is 98 feet by 111 feet in plan, or ¼ acre in area, with a depth of 7 feet, giving it a content of 1¾ acre feet of filtering material. For a flow of 100,000 gallons per day, it will give a rate of only 57,000 gallons per acre foot per day, or with a flow of 300,000 gallons per day, a rate of 171,000 gallons per acre foot per day, rates apparently well within permissible lines. The filter sides are composed of extremely heavy unventilated walls of concrete. The bottom is of concrete 6 inches to 12 inches thick on a cinder fill. The filter is to be drained by gutters formed in the concrete bottom. These gutters are to be covered with tile 2 inches thick and 2 feet square, and are to be ventilated at their upper ends by 6-inch riser pipes. Concrete expansion joints are provided throughout. Four-inch ground water drains to relieve pressure under the filter floor are provided. These drains are to discharge into the effluent pipe of the final settling tank.

Distribution on the sprinkling filter is accomplished by 6-inch castiron pipes laid 5 feet below the filter surface and supported on concrete posts, with 3-inch castiron risers and 59 circular spray nozzles placed about 14 feet on centers. The filter medium is to be broken stone passing a 2½-inch ring and retained by a 1-inch ring.

Final Settling Tank

The final settling tank is to be built with materials and on lines similar to those of the primary settling tank but slightly smaller in capacity and not in duplicate. Its total capacity is about 34,000 gallons, of which about 8,000 is in the upper section and 12,000 below the 6-inch slot. As in the primary tanks, lead wash-water pipes and an 8-inch sludge blow-off are provided. At the rate of 100,000 gallons per day, this provides a detention period in the upper chamber of nearly 2 hours, and about 3.4 hours for a flow at the rate of 300,000 gallons per day, and a sludge capacity of 4 gallons per capita.

Chlorination Tank

The chlorination tank is in a heated tin-roofed frame building 14 feet by 18 feet in outer dimensions. The tank itself is divided by 3 partitions into four channels giving a minimum length of flow of about 25 feet, which if desired could be increased almost 50 per cent without additional cost by placing the inlet and outlet respectively at the ends of the end channels instead of more nearly opposite their outlets or middle points. The area of the channel is about 8 square feet, its depth 2½ feet, and the contents of the entire tank about 3,000 gallons, giving a detention period for a rate of 100,000 gallons per day of about ¾ of an hour. The liquid chlorine sterilizing device is of a direct feed pattern and capable of applying chlorine at a maximum rate of not less than 1 pound per hour. Under these conditions, not less than 5 parts of chlorine per 1,000,000 parts of sewage treated should be applied to the effluent.

Sludge Beds

The sludge beds are well underdrained and appear to be of ample size. That for the primary beds is to be 34 feet 6 inches square, with an area of 1,560 square feet or .036 acre, giving an area of 1½ square feet per capita for 1,000 persons, or it will hold a dose of about 12,000 gallons per foot of depth. The sludge bed for the secondary settling tanks is 24 feet square, giving it an area of 575 square feet or .013 acre. It will have therefore an area of ½ square foot per capita for 1,000 persons, or a sludge capacity of over 4,400 gallons per foot of depth. Both beds are about 13 inches deep and similar in construction, with 1¾-inch stone around the drains and joints; above this, 8 inches of 1-inch stone followed by 3 inches of fine stone between 1/16 inch and ¼ inch in size, and the whole finished a 2-inch surface layer of mortar sand. It would be desirable to provide riprap in front of the aprons in order to check the velocity of the sludge discharge and prevent scouring of the beds.

The sides of the sludge beds are to be riprapped to a height of 4 feet above the bottom of the underdrains. Sludge would penetrate this riprap faster than it would the upper 6 inches of filter material. It is therefore recommended that for 1 foot in elevation, both above and below the surface of the sludge beds, the riprap be either set in cement mortar or thoroughly grouted with cement grout. Much of the disposal plant is set in heavy side-hill cutting, and the new cut bank slopes, some of which are between 20 and 25 feet in length, are accordingly a danger in cases of deep frost, severe rainstorms, etc. It is, however, planned that these are to be at once heavily sodded. This, with their fairly easy slope of 1 on 1½, should enable them to be easily maintained with proper attention.

Submerged Outfall

The plan shows an outfall pipe 700 feet long. The length of the pipe, however, as scaled from the profile, is about 660. There appears, therefore, to be a slight discrepancy in the plans. The total fall in the pipe from the chlorinating building to the end of the effluent pipe in the canal. 10 feet below low water, is 15 feet, but the hydraulic slope or fall from the effluent surface in the chlorination tank to the low water surface in the canal is only 5 feet. The effluent pipe is, nevertheless, not shown to have a continuous slope between these points, but to have an abrupt drop of 3 feet at a manhole 60 feet from the chlorinating building, leaving about 2 feet of hydraulic head for the remaining 600 feet provided the canal is at its low water stage. The extent of this drop in grade elevation at the upper end of the line would appear to unduly increase the depth and the extent of costly deep water construction. Furthermore, it keeps the effluent standing in about 500 feet of pipe even when there is no flow at all, and the pipe would be under a head in from 50 to 100 feet more when the maximum flow is forcing its way out. The Department has been advised, however, at a conference with representatives of the State Architect's Department, that the length of iron pipe is to be increased and that it is expected to construct this work at a time when the canal is unwatered.

It is assumed that before the disposal plant is put in operation plans will be submitted providing a water supply therefor, either by extension from the present approved supply or other source.

As a result of our examination of these plans, and after a careful consideration of the local conditions and features of design, I recommend that these plans for the proposed sewerage system and disposal plant for the Marcy Division of the Utica State Hospital be approved.

Respectfully submitted
THEODORE HORTON
ALBANY, N. Y. *August 3, 1920* *Chief Engineer*

MIDDLEBURG (High School)

Plans were approved on July 9, 1920, for sewage disposal for the high school in School District No. 1 of the town of Middleburg, located in the village of Middleburg, Schoharie county. The plans provided for a sewage disposal plant consisting of a settling tank, diverting chamber, and subsurface irrigation system. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Education of School District No. 1, town of Middleburg, to discharge effluent from the proposed sewage disposal plant at the High School in said school district at Middleburg into the ground waters tributary to a small branch of Schoharie creek, within the municipality of Middleburg, Schoharie county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal plant.

2. That no sludge shall be discharged into any stream or other body of water, or deposited on the surface of the ground where it might be washed by rain or melting snow into any stream or other body of water.

3. That the subsurface irrigation system shall contain not less than 10 feet of distributing tile per person served, and that the lateral distributing tile shall be laid in trenches backfilled with not less than 6 inches of coarse cinders, broken stone, or gravel in such a manner that the lines of tile shall be covered and surrounded with such coarse material.

4. That whenever required by this Department, the subsurface irrigation system shall be extended or some other suitable method of disposal of the sewage from this school shall be provided under plans which must first be submitted to and receive the approval of this Department.

5. That no part of any distributing tile of the subsurface irrigation system shall be less than 5 feet from the top of the bank of the stream near the disposal plant.

6. That the ends of all lines of distributing tile on the sides of the subsurface irrigation system near the stream be effectively plugged.

M. NICOLL, JR.
July 9, 1920 *Deputy State Commissioner of Health*

MIDDLETOWN (State Homeopathic Hospital)

The following plans were approved during 1920 for the State Homeopathic Hospital at Middletown, Orange county:

On April 8, plans for sewer and water extensions.

On August 18, plans for sewage disposal, cottage for patients, Comfort farm.

On September 13, plans for underground sewer connections for chronic hospital.

On October 19, amended plans for sewage disposal for cottage for patients, Comfort farm.

On October 29, plans for sewer and water extensions.

NAPLES (Steuben Products Company)

Plans were approved on June 11, 1920, for the disposal of canning wastes and floor washings from the factory of the Steuben Products Company, in the village of Naples. The plans provided for the treatment of the wastes in septic tanks and by sand filtration. The sanitary sewage and ensilage drainage is to be disposed of by leaching cesspools. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 78 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Steuben

Products Company to discharge effluent from beneath the ensilage pit into the ground water and from the drains of the sand filter of the proposed disposal plant into the waters of the State tributary to Naples creek, within the village of Naples, Ontario county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That both the ensilage drain pit and the sewer and disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
2. That additional filters shall be constructed when required under plans which must first be submitted to and receive the approval of this Department.
3. That no storm water or surface water or unpolluted cooling water shall be discharged into the settling tanks or onto the sand filters.
4. That the sludge shall be buried or otherwise disposed of without nuisance, and that no sludge shall be discharged into any stream or body of water of this State or be deposited on the surface of the ground where it might be carried thereto by rain or melting snow.
5. That the filtering material over the gravel surrounding and covering the underdrains shall consist of a layer of sand not less than 30 inches deep and having an effective size of not less than 0.2 millimeter nor more than 0.5 millimeter, and a uniformity coefficient of not greater than 5.

M. NICOLL, JR.
June 11, 1920 *Deputy State Commissioner of Health*

NEWFIELD (Town) (District School No. 2)

Plans were approved on January 31, 1920, for a sewage disposal plant to serve the public school in District No. 2 of the town of Newfield, Tompkins county. The plans provided for a sewage disposal plant consisting of a settling tank, dosing chamber, and subsurface irrigation field. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Education of School District No. 2, town of Newfield, Tompkins county, to discharge effluent from the proposed sewage disposal plant to serve the public school in District No. 2 into the ground waters of the State tributary to the west branch of Cayuga inlet, within the town of Newfield, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers.

5. That the sludge be removed from the tank when necessary in such a manner as to cause no nuisance and disposed of by burying in some remote place, and that no sludge from any part of the disposal plant be deposited in any watercourse or on or in the ground in such a manner that it may be washed by rain or melting snow into any watercourse.

6. That the drain tile be laid so that the depth from the surface of the ground to the top of the tile shall in no case be greater than 18 or less than 12 inches.

M. NICOLL, JR.

January 31, 1920 *Deputy State Commissioner of Health*

NEW WINDSOR (Town) (District School No. 1)

Plans were approved on August 30, 1920, for a proposed sewage disposal plant for the public school in School District No. 1 in the town of New Windsor, Orange county. The plans provided for the treatment and disposal of the sewage in works consisting of a settling tank and two batteries of cesspools of 5 cesspools each. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Trustees of School District No. 1, town of New Windsor, to discharge sewage effluent from the proposed system of leaching cesspools into the ground waters tributary to the Hudson river within the town of New Windsor, Orange county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers.
2. That when necessary sludge shall be removed from the proposed tank in such a manner as to cause no nuisance, and disposed of by burying in some remote place or in some other satisfactory manner.
3. That no sewage, scum or sludge from any part of the disposal works or sewer system tributary thereto shall be discharged into any watercourse or body of surface water, or deposited where it may be carried thereinto by rain or melting snow.
4. That whenever required by the State Commissioner of Health, satisfactory detailed plans for extension to the proposed plant or for other satisfactory method of disposal of the sewage of the school shall be submitted for approval; and upon approval of said plans any or all portions of such extensions or works for some other method of disposing of the sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.

August 30, 1920 *Deputy State Commissioner of Health*

NORTH HEMPSTEAD (Town) (Great Neck Sewer District)

Amended plans for relocation of a sewer on Fifth street, in the Great Neck Sewer District of the town of North Hempstead, were approved on December 10, 1920. No permit was issued since no additional sewers were to be constructed and no sewage was to be discharged in addition to that provided for by the plans originally approved.

NORTH HEMPSTEAD (Town) (Port Washington Sewer District)

Plans were approved on May 14, 1920, for sewer extensions in Carlton and Ohio avenues and Washington and High streets, in Port Washington Sewer District No. 1 of the town of North Hempstead. The permit issued in connection with the approval of the plans follows:

Permit

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Sewer Commissioners of Port Washington Sewer District No. 1 of the town of North Hempstead, Nassau county, N. Y., to discharge sewage from the proposed sewer extensions after treatment in the Port Washington sewage disposal plant into the waters of Manhasset bay, through the existing outfall from the sewage disposal plant within the town of North Hempstead, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewer extensions.
4. That no sewage sludge or scum from any part of the disposal works shall be discharged into Manhasset bay, or into any of the waters or tributaries of Long Island sound or New York bay, or within 10 miles of any shore except that such sewage, sludge or scum may be deposited on land at such points and in such a manner as may be approved by the State Commissioner of Health.
5. That whenever required by the State Commissioner of Health, satisfactory detailed plans for an extension of the outlet pipe from the disposal works or for additional works for more complete treatment of sewage shall be submitted for approval; and after approval of said plans such extension of the effluent pipe or any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, Jr.
May 14, 1920 *Deputy State Commissioner of Health*

Amended plans were approved on October 29, 1920, for changes in the sewers in High and Locust streets, in the Port Washington Sewer District No. 1, in the town of North Hempstead. No permit was issued in connection with the approval of these plans since they were simply amendments to plans already approved and since they did not provide for the discharge of sewage not contemplated by plans heretofore approved.

NUNDA (Peck & Pratt Condensed Milk Company)

Plans were approved on January 7, 1920, for sewage and waste disposal plants to serve the Peck & Pratt Condensed Milk Company's factory at

Nunda, Livingston county. According to the plans, it was proposed to treat the wash water in a settling tank and discharge the effluent from that tank into Keshequa creek, and to dispose of the domestic sewage by means of a settling tank and subsurface irrigation system. The permits issued in connection with the approval of the plans follow:

PERMITS

Application having been duly made to the State Commissioner of Health, as provided by section 78 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Peck & Pratt Condensed Milk Co. to discharge effluent from the proposed disposal plant to treat the trade wastes from their condensery at Nunda, Livingston county, N. Y., into the waters of Keshequa creek, within the municipality of Nunda, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That no sludge from any part of the disposal works shall be discharged into Keshequa creek or any other watercourse, or be deposited on the surface of the ground where it might be washed by rain or melting snow into Keshequa creek or any other watercourse.
4. That only wash water from the cans, tanks, and floors, and no storm water or condenser water be permitted to enter the tanks, and that no sewage be permitted to enter the tanks or the outfall sewer.

M. NICOLL, JR.
January 7, 1920 *Deputy State Commissioner of Health*

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Peck & Pratt Condensed Milk Co. to discharge effluent from the proposed sewage disposal plant to treat the domestic sewage from their condensery at Nunda, Livingston county, N. Y., into the underground waters of the State tributary to Keshequa creek, within the municipality of Nunda, in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof, except as required by section 4 and 5 of this permit.
4. That the length of the proposed settling tank be increased so as to make its dimensions approximately 4 feet by 7 feet by 5 feet deep below the flow line.
5. That the baffle near the outlet end of the tank be extended to about 12 inches below the normal flow line of the tank.

6. That only domestic sewage and no storm water, wash water, condenser water, or other wastes be permitted to enter the plant.

7. That no sludge from the plant be deposited on or in the ground within 200 feet of any well or watercourse, or deposited in such place or manner that it might be washed by rain or melting snow into any watercourse or near any well.

M. NICOLL, JR.
January 7, 1920 *Deputy State Commissioner of Health*

OGDENSBURG

On April 21, 1920, plans were approved for a trunk sewer and sewer laterals in the city of Ogdensburg, in Barre, Jay, Knox, and Champlain streets. The permit issued in connection with the approval of the plans contained only the usual revocation and modification clauses.

On June 3, 1920, plans were approved for the proposed extension of a sewer in Green street. The permit issued in connection with the approval of the plans contained only the usual revocation, modification, storm water, and complete construction clauses.

On July 1, 1920, plans were approved for a sewer extension on South Rosseel street. The permit issued in connection with the approval of the plans contained only the usual storm water and complete construction clauses.

On September 17, 1920, and October 15, 1920, plans were approved for sewer extensions on Champlain street and Ogden street respectively. The permits issued in connection with the approval of these plans contained in addition to the storm water clause, the following condition:

That the flush pipe and cover be so arranged that it shall not be directly connected to the riser pipe, and that it be so built that breakage may not result from settlement or from surface disturbances being directly transmitted to the riser pipe or sewer line.

ORWELL (Town) (Ideal Rest Sanatorium)

Plans were approved on April 20, 1920, for a sewage disposal plant for Ideal Rest Sanatorium, in the town of Orwell, Oswego county. The plans provided for a settling tank and sewer to Orwell creek. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Dr. P. D. Bailey to discharge effluent from the sewage disposal plant of the Ideal Rest Sanatorium into the waters of Orwell creek on his property, within the town of Orwell, Oswego county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the sewage disposal works.

4. That no sewage sludge from any part of the disposal works shall be discharged into Orwell creek or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.

5. That when necessary the sludge shall be removed from the tank in such a manner as to cause no nuisance, and disposed of by burying in some remote place.

6. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment of the sewage of the sanatorium shall be submitted for approval; and upon the approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as the said Commissioner may designate.

M. NICOLL, JR.
April 20, 1920 *Deputy State Commissioner of Health*

OSSINING (Sing Sing Prison)

Amended plans for sewer extensions to serve the new clinic building, detention building, and mess hall at Sing Sing Prison were approved on February 11, 1920. On June 17, 1920, plans were approved for a relocation of the proposed sewage pumping station, and on July 3, 1920, plans were approved for a second relocation of the pumping station. Plans for the relocation of a portion of a sewer were approved on July 27, 1920. No permits were issued in connection with the approval of these plans.

OYSTER BAY (Town) (District School No. 12)

Plans for sewage disposal for the public school of District No. 12, at Syosset, in the town of Oyster Bay, were approved on August 30, 1920. The plans provided for the disposal of the sewage by two leaching cesspools designed to operate in series. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Board of Trustees of School District No. 12, town of Oyster Bay, to discharge sewage effluent from the proposed system of leaching cesspools into the ground waters tributary to the Atlantic ocean within the town of Oyster Bay, Nassau county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal plant.

2. That the sewage disposal plant shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof, except that the inter-connecting pipes be made 5 inches in diameter and the manhole openings be made 24 inches in diameter.

3. That when necessary the sludge shall be removed from the proposed plant in such a manner as to cause no nuisance, and disposed of by burying in some remote place.

4. That whenever required by the State Commissioner of Health, additional cesspools shall be installed, or detailed plans for some other

satisfactory method of disposal of the sewage of the school shall be submitted for approval; and upon the approval of said plans any or all portions of such disposal plant for the complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.
August 30, 1920 *Deputy State Commissioner of Health*

PARIS (Town) (Clayville Knitting Company Development)

Plans for a sewer system and disposal works for a housing development of the Clayville Knitting Company, in the town of Paris, were submitted to this Department for approval on July 10, 1920. The unapproved plans were returned for revision, the report upon the examination of the plans following:

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on the examination of plans and application for a sewer system and disposal works for a housing development of the Clayville Knitting Company, just outside the corporation limits of the village of Clayville, in the town of Paris, Oneida county, N. Y., submitted to this Department for approval by the engineer for the company on July 10, 1920.

ENGINEER'S REPORT

The report of the engineer states that the proposed sewer and disposal works are designed to provide for a population of 250 persons in this private housing development which the Clayville Knitting Company is now engaged in building on their property. This development is planned ultimately to comprise about 50 houses. The application states that 10 of these houses are contemplated for present construction.

General Location

Clayville is located on the Delaware, Lackawanna and Western railroad about 15 miles south of Utica, on the southerly side of the watershed of the Mohawk river. The village has a population of about 1,000 persons, and is built on both sides of Saquoit creek and around the pond formed by a dam on the creek at this point. The housing development property of the Clayville Knitting Company is situated about half a mile north of the village and east of the main highway along which most of the town is constructed, and which lies between this property and the creek.

General Design

The plans submitted show a nearly rectangular tract of land for building site about 500 feet by 1,000 feet in size, located at an elevation of about 100 feet higher than the creek. The upper or westerly portion of this tract is subdivided by curved streets and plots for which sewers are to be provided. The sewage is then to be conveyed by gravity in a northwesterly direction about 1,600 feet across a cemetery, private land, and a highway, and through areas shown as owned by the Clayville Knitting Company, on the Saquoit creek. It is planned to treat the sewage at this point in duplicate two-story settling tanks, with an auxiliary sludge filter, before discharging it into the creek. This creek has an area of watershed of over 10 square miles above Clayville, and receives considerable pollution above this point of discharge and is not suitable as a source of domestic water supply.

Detailed Examination

The plans have been carefully examined with respect to the sewerage and sewage disposal works. In connection with the sewerage system the design has been carefully studied with reference to alignment, sizes, grades, capacities, facilities for cleaning and inspection and flushing, and other features of a hydraulic or sanitary nature. In connection with means for sewage disposal, it has been studied with reference to general method and efficiency of the sewage treatment plant as a whole, and of the capacities and practical operation of the individual structures, appurtenances, and apparatus, and particular recommendation made looking toward a possible improvement of the regulation of flow through the settling tanks.

Alignment and Details

The sewers, including the outfall, are all to be of 8-inch vitrified pipes laid on slopes of 0.6 per cent or over, which should give them self-cleansing velocities and ample capacity. They are to be so located that the cuts will vary from 3 feet to 11 feet, and are to be laid largely through the rear portions of the lots apparently for the purpose of shortening the house branches. Manholes are provided at all deflections and at intervals of not over 400 feet. If the possibility were less remote of this subdivision being taken into a municipality, the location of lateral sewers off of streets might be a serious objection. In this case it is felt that the curved streets and other circumstances make permissible the alignments chosen, and for similar reasons the location of the angle manhole which is shown on the side instead of the center of the highway marked on the plans Church street extended, appears satisfactory. It is, however, desirable whenever possible to place both sewers and manholes in the centers of streets and highways.

Disposal Site

The disposal site is located about 500 feet from Church street extended. The geological survey of 1904 shows a highway along which are houses, which highway crosses the creek about one-half mile below where the effluent is planned to be discharged. The plant structure itself is located on the higher portion of a trapezoidal plot about 120 feet by 150 feet on a side. The bank of the creek at this point slopes from elevation 948 to 908, or about 40 feet in 200 feet, to a low wet area along the stream. The treatment tank is planned for construction about midway up on this bank.

Disposal System

The sewage is to enter a distribution manhole adjacent to the reinforced concrete settling tanks, into either or both of which it can be diverted. The piping and gates are shown to be so arranged as to permit the sewage flowing through the tanks either in series or in parallel, and to enter a discharge manhole at elevation 927, and to leave this manhole 18 feet lower, at elevation 909, through an 8-inch effluent pipe on a 0.75 per cent slope, which then conducts it 130 feet to a point of discharge into the stream near the east bank of the creek. Care must be taken to prevent odors from arising from the sudden drop and splash of the effluent where it falls 18 feet vertically in the discharge manhole and a downcast pipe should be inserted if a nuisance from this cause should arise.

Treatment Tanks

The duplicate settling tanks are planned to be built of reinforced concrete and are provided with 3-inch cypress covers. It is suggested that all parts of the disposal plant except the sludge filter be covered, and that where planks are used these should be thoroughly painted to prevent harboring insects and decay, and the planks should be chained together or otherwise secured against removal. These tanks are each 7 feet square by 13 feet deep. Their combined hydraulic capacity is to be 8,000 gallons, or sufficient if unsubdivided for 8 hours detention of sewage at a normal rate from 250 persons. The upper portion of each of the 2 tanks is, however, to be subdivided into 2 upper or settling compartments by a central wall 12 inches wide at the top, 6 feet deep, and running the length of each tank. These upper compartments are to have bottoms formed by 3-foot slate slabs ⅞ inches thick, laid on a slope of 4/5 on 1, and having a 6-inch slotted opening between their lower edges and the outer walls of the main tanks. The slate slabs must be protected from breakage and frequently examined to ascertain their condition. As slight a slope as that used has been found in other cases to retard the downward movement of deposits; for this reason a slope of at least 1½ to 1 is recommended for these slate slabs. Also that baffles about 9 inches from the outlet extending a foot below the surface, or other means, be provided for preventing the escape of fragments of scum or large undigested particles into the stream, and similar baffles be provided to distribute the inflow as widely and as early as possible.

Capacity of Tanks

These 2 upper compartments of each tank together are to hold 1,350 gallons, while the useful sludge capacity measured from a foot below the bottom of these compartments is 1,400 gallons, and the chimney or central well section together with the unavailable section above the sludge about 1,250 gallons for each main tank. Thus both tanks combined give normally, for 250 persons, in the upper portion a settlement detention period of between 1½ hours and 2 hours and an apparently satisfactory sludge capacity of 11 gallons per capita in the lower portion.

Uniformity of Flow

It is planned for the sewage to enter the tanks from 2 long 8-inch bends extending out nearly 2 feet from the wall, thus materially lessening the length of flow through each tank. The sewage enters these bends through 2 openings in the side of flat bottomed trough 18 inches wide to which the sewage is admitted at one end. In practice it has been found that such exposed and putrefying settlements giving out foul odors rapidly form in the angles and portions of such troughs where cleansing flow is not constant; and furthermore, that the channel to the second opening soon becomes obstructed so that the sewage following the line of least resistance is all diverted into one of the compartments thus losing half the detention period and about half of the value of the tank installation. The curved end connections, although permitting the tanks to be operated in series, cannot be approved as shown, as they could be arranged to by-pass the sewage around the tanks. It is accordingly recommended that these curved end connections be omitted, and that the entrance of the sewage to the settling tanks be so arranged by a short end trough with baffle protected weir or otherwise that it will have equal distance as short as possible to flow to reach each compartment.

Sludge Treatment

The tanks as planned have hopper bottoms at about elevation 914, or 13 feet below the water surface in them. In these bottoms a 10-inch iron pipe provided with a gate valve will permit the sludge to be drawn into a manhole 4 feet square with bottom elevation 913. From here the sludge is to be led through 15 feet of sewer to sludge bed, at elevation 912.5, 1 foot above the surface of the sludge filtering material. The sludge filter is to be 25 feet in length by 5 feet in width, and is to have vertical walls rising 3 feet above its sand surface. Its area is to be 125 square feet, or ½ square foot per capita. Its capacity is to be 940 gallons per foot, or 2,800 gallons for 3 feet, which equals the combined useful sludge capacity of both main tanks together. The filter medium is to be 1 foot of coarse sand underdrained by 4 lines of 4-inch tile bedded at the bottom of a 6-inch layer of gravel.

As a result of our examination of these plans and after a careful consideration of the features of the design, I would recommend that the plans be returned for the following additions and amendments:

1. That the inlets to the settling tanks be so formed that the sewage will have an equal distance to flow to each settling compartment if two compartments are used for each tank, and so that it will begin its flow in each compartment behind distributing baffles placed near the wall of the tank through which it first passes; and further, that both protruding inlets and also the curved pipe outlet and any by-passes be omitted.

2. That the slope of the slate slabs in the bottom of the settling compartments be increased to not less than 1.2 vertical on 1.0 horizontal, and that the outlets of these tanks be protected by baffles.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *August* 7, 1920

Amended plans were approved on September 14, 1920, for a sewer system and disposal works for the housing development of the Clayville Knitting Company. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Clayville Knitting Company to discharge effluent from the disposal plant to be constructed in connection with the proposed sewer system to care for the sewage from the property of said company at Clayville, into the waters of Saquoit creek, within the town of Paris, Oneida county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That only domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers and sewage disposal plant.
2. That no sewage sludge from any part of the disposal plant shall be discharged into Saquoit creek or any other body of water, or deposited on the surface of the ground where it may be washed by rain or melting snow into Saquoit creek or any other body of water.
3. That the floor of the inlet manhole be sloped toward the path of flow of the incoming sewage.
4. That a difference in elevation of the crests of the inlet and outlet weirs of at least 1 inch be provided.
5. That the projection from the wall of the settling tank designed to trap the gases resulting from the digestion of sludge be so increased in size as to provide a trap of at least 4 inches to prevent these gases from reaching the sedimentation chamber.
6. That at least one line of perforated lead pipe be provided extending around the four sides of each hopper of the settling tank, so designed as to furnish an efficient means of loosening the accumulated sludge preparatory to blowing it off.
7. That the sludge blowoff valves be located in the outlet manhole.
8. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment of the sewage of the realty development of the Clayville Knitting Company, shall be submitted for approval; and after the approval of said plans, any or all portions of such additional or supplementary works for more complete treatment of the sewage, shall be constructed and put in operation at such time or times as said Commissioner may designate.

M. NICOLL, JR.
Acting State Commissioner of Health

September 14, 1920

PELHAM MANOR

Plans for alterations and extensions to the sewerage system of the village of Pelham Manor were approved on February 25, 1920. The plans contemplated the construction of sewers in Iden and Reed avenues and other streets and private ways in the northeast part of the village. The permit issued in connection with the approval of the plans contained in addition to the usual revocation, modification, complete construction and storm water clauses, the following condition:

That all sewage to be collected by the proposed sewers shall be treated in the sewage disposal works of the town of Pelham.

PORT CHESTER

Plans were approved on December 8, 1920, for a proposed sewer extension in Beech street, in the village of Port Chester, Westchester county. The permit issued in connection with the approval of the plans allows the discharge of effluent from the proposed sewers through the disposal works into the waters of Long Island sound, through the existing outfall sewer at the harbor of Port Chester, and contains, in addition to the usual complete construction and storm water clauses, the following condition:

That whenever the 40-foot extension east from the manhole on the 8-inch sewer near the easterly end of Beech street is constructed, a manhole shall be provided at the easterly end of this extension.

RENSSELAER

Plans were approved on October 16, 1920, for extensions of outfall sewers in Central avenue and Tracey street, in the city of Rensselaer. No permit was issued in connection with the approval of the plans since the proposed extensions did not provide for the discharge of any additional sewage.

ROCHESTER (State Hospital)

Plans were approved on October 29, 1920, for modifications and additions to the sewage pumping station of the Rochester State Hospital.

RYE

Plans were approved on January 28, 1920, for modifications and extensions to the sewerage system and sewage disposal plant of the village of Rye. The report upon the examination of the plans and the permit issued in connection with their approval follow:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on the examination of plans for modifications and extensions to the sewerage system and sewage disposal plant of the village of Rye, Westchester county, New York, submitted to this Department for approval by the Board of Trustees of the village on January 27, 1920.

Preliminary plans for a comprehensive sewerage system and sewage disposal plant for the village were approved by this Department in June, 1907, subject to subsequent approval of detailed plans of the system and disposal plant. These detailed plans were submitted during the following year and approved on September 15, 1908. A large part of these sewers and the disposal plant were constructed during the years 1909 and 1910 and have been in operation since then. The plans now submitted contemplate the construction of some of the lines shown on the 1908 plans but not constructed, and a few additional laterals not shown on those plans; the substitution of cast-iron for the vitrified pipe shown on the original plans through certain low wet areas; the formation of the new low level district to serve the Rye Town

Park district; the construction of a pumping station to serve this district; and the construction of a new sewage disposal plant to be located on Blind brook.

According to the map and profiles submitted, it is intended to construct about 8¾ miles of new sewers in the near future. With the exception of about ½ mile of 10-inch sewer, and a short length of the outfall sewer from the disposal plant, these lines will be 8 inches in diameter. In general they will be of vitrified tile pipe. The 10-inch line just mentioned and a section of 8-inch sewer on the same street, however, which will be in low wet ground, are to be of castiron pipe laid with leaded joints in order to prevent the possible infiltration of ground water. The proposed grades of the sewers have in many cases been made very flat in order to avoid excessive rock excavation and deep trenches in wet ground. The minimum grade used for the 8-inch lines is 0.25 per cent, a slope which will cause a low velocity and consequent sedimentation and which will make it necessary that the sewers be carefully laid and frequently inspected and flushed if stoppages are to be avoided. Manholes will be provided at intervals of from 300 to 350 feet, and flush tanks fitted with automatic siphons will be provided at the upper ends of all lateral sewers.

The small low level system near Rye Town Park comprises about a half of a mile of 8-inch sewers draining to a pumping station which will discharge the sewage through a 6-inch force main about 400 feet long into the gravity system at the corner of Forest and Dearborn avenues. The maximum flow to this pumping station will probably not exceed about 75 gallons per minute.

The pumping station is to be a circular reinforced concrete structure 12 feet in diameter. The lower part of the building, which extends 18 feet below the surface of the ground, forms a pump well and screen room and is surrounded by a one-story building housing the motors and switchboard. The pump well is divided by a partition and screen into two compartments. The sewage enters through an 8-inch inlet pipe and falls to the first compartment, from which it passes through a screen consisting of ¾-inch angles set 1½ inches apart and having a gross submerged area of about 20 square feet into the second compartment, which contains two submerged centrifugal pumps. The depth of the pump well below the high-water line is 4 feet, and the total available capacity of the well about 3,300 gallons. There is no overflow to the pump well. Each of the two pumps will have a 4-inch discharge and a capacity of 100 gallons per minute, and each will be provided with a vertical motor on the same shaft located in the motor room above the level of the ground. Floats and float switches will be provided for controlling the motors. The pumps and motors will be so arranged that either of the pumps may be readily raised for inspection and repairs without interference with the operation of the other. The power will be obtained from the Westchester Lighting Co. No auxiliary source of power is provided, it being considered that the source of power which includes four separate generator plants makes the possibility of interruption of service a very remote one.

At the present time the sewer from the section of the village known as the Rye Beach district, amounting to about 135,000 gallons per day, drains by gravity to the disposal plant located near Manursing Island; and that from what is known as the Blind Brook district, amounting to about 395,000 gallons per day, drains to a settling tank and pumping station on the east side of Blind brook and is pumped from there to the disposal plant just mentioned. There are about 11,500 feet of sewers in the first district, and about 25,600 feet in the latter district.

It is now proposed to construct a new sewage disposal plant on the west bank of Blind brook to treat the sewage from the Blind Brook district, and to continue the operation of the Rye Beach plant to treat only the sewage from the Rye Beach district and the new Rye Town Park district the sewage from which will be discharged into the Rye Beach system. The use of the existing Blind Brook pumping station will be continued as at the present, except that a new settling tank will be added, and the force main will be arranged to discharge the sewage to the new Blind Brook plant instead of to the present disposal plant.

It is estimated that in 1925 the flow from the Rye Beach district which will then have about 24,300 feet of sewers, including trunk sewers, will be about 289,000 gallons per day. Under the new arrangement the present Rye Beach plant will be used to treat this sewage. The total capacity of the existing settling or digestion tanks now in use at this plant is, according to the plans on file in this office, about 100,000 gallons, which will give an average detention period of 8 hours with the estimated flow of 289,000 gallons per day if the entire tank is used, or a shorter period if some of the compartments are cut out. The portion of the sprinkling filter which has been constructed and is now in use has an area of .027 of an acre, which will give a rate of about 1,100,000 gallons per acre per day, or a little less than 200,000 gallons per acre per foot of depth per day with the estimated sewage flow. It seems apparent, therefore, that the old plant will have ample capacity to care for the sewage which will reach it under the new plan.

According to the engineer's report, there will be 69,000 feet of sewers including trunks in the Blind Brook district after the proposed extensions are completed, and he estimates that the flow from these sewers in 1925 will be about 625,000 gallons per day. This sewage will be cared for by the present Blind Brook pumping station and the proposed new disposal plant.

In order to provide for the additional sewage that will be received from the new extensions, another compartment, built in accordance with the plans approved by this Department in 1908, will be added to the three compartments of the settling tank now in use at the Blind Brook station. This will make the total capacity of the settling tank 192,000 gallons, or the equivalent of 7.4 hours average flow based on the estimated daily flow of 625,000 gallons. The pumps will not be altered, their capacity being sufficient to care for all the sewage that will be received. The present force main will be cut and a Y and suitable valves arranged so that the sewage may be discharged to the new plant. A 16-inch castiron force main about 500 feet long will be laid between the Y and the proposed disposal plant.

The proposed new disposal plant is to consist of dosing chambers, sprinkling filters, chlorination plant, final settling tank, and sludge beds for use in connection with the final settling tanks. The effluent from the plant will be discharged into Blind brook at the village dock and below the dam near the foot of Hewlett street.

The settled sewage from the Blind Brook pumping station will be discharged into a trough connecting the two dosing chambers of the sprinkling filter and divided approximately equally between them. Each of these chambers is of concrete, paraboloidal in shape, and has an available capacity of 2,000 gallons. A 10-inch siphon is provided in each chamber for discharging its contents into the distribution systems of the sprinkling filters. The engineer estimates that each discharge of 1 siphon will amount to about 4,600 gallons, including the inflow during discharge. This inflow will be variable due to the fact that it will be received from the pumping station where one or more pumps may be in operation; and it is possible that at times the period of discharge may be materially lengthened, a condition which must be carefully considered in connection with the size of the siphons, which should be large enough to break properly if a uniform distribution is to be obtained. In this case the siphons appear to have sufficient capacity to care for the flow if the pumps are operated so as to produce a uniform discharge, but they may cause unsatisfactory distribution if the pumps are operated irregularly. Care should therefore be taken to secure uniform operation or larger siphons or an additional unit installed to care for the flow.

The sprinkling filter is to be built up of coke, of such size as will pass a 1½-inch screen and stop on a 1-inch screen. The bed is to be open on the sides, from 6 feet to 6½ feet in depth, and will have an area of about 0.37 of an acre, making the rate of filtration with the estimated flow about 1,700,000 gallons per acre per day. The bed will be divided into two approximately equal parts, each connected to one of the dosing chambers mentioned above. The distribution system consists of castiron pipe varying from 12 to 4 inches in diameter, laid near the surface of the beds, with 2½-inch risers to the nozzles. There are 47 nozzles on one section of the bed and 46 on the other, making a total of 93. The nozzles are staggered and set 14 feet on centers. The head on the nozzles will vary from a maximum of 7.5 to a minimum of about 2.0 feet. The bottom of the bed will be covered by 8-inch half tile arranged to form a false bottom and allow the effluent to flow to the main drainage channels and thence to the chlorinating plant. The plans provide for future extensions to the filter and its appurtenances, to increase its capacity to about 1½ times its proposed present capacity.

A chlorinating plant, consisting of a float controlled liquid chlorine apparatus and mixing tank, is located immediately adjacent to the filters. Here the sprinkling filter effluent will be treated with liquid chlorine at the rate of 5 parts per million, and caused to flow through mixing troughs fitted with suitable baffles to the final settling tank. The plans call for only one chlorinating machine. These machines frequently break down, and it would seem desirable that two machines be installed to prevent possible interruption of the application of the chlorine due to the failure of one piece of apparatus.

The final settling tank is an open concrete basin divided into 2 equal parts, each 28 feet by 30 feet in plan, and having a depth of 3 feet 2 inches, making its total capacity 38,000 gallons, the equivalent of about 1½ hours average flow. The chlorinated filter effluent will enter the compartments at the corners near the chlorinating plant and leave over weirs extending the full width of the sections at the side farthest from the filters. A scum baffle set 12 inches from each weir and extending from 5 inches above to 7 inches below the surface of the liquid is provided to prevent the escape of floating particles.

The effluent from the final settling tanks passes through a 12-inch inverted siphon about 430 feet long, operating under a maximum available head of 7 feet, to the east sides of Blind brook, and thence through the outfall sewer for about 2,000 feet to the outlet at the village dock.

Two sand beds, each 50 feet by 35 feet in plan, furnishing a total area of 3,500 square feet, will be provided for drying the sludge from the final settling tanks. These beds contain 1 foot 2 inches of sand, and are provided with 3-inch underdrains 10 feet on centers for collecting the effluent. The underdrains are connected to an 8-inch tile pipe which discharges into Blind brook opposite the plant. The sludge will be conducted from the final settling tank to the sludge beds by an 8-inch pipe and discharged onto the beds over concrete aprons arranged to prevent the sludge from disturbing the sand in the beds.

In view of the results of our examination of these plans, and after careful consideration of the essential features of the design and of local and general requirements, I would recommend that the plans be approved, and a permit issued to the trustees of the village allowing the discharge of the sewage from the proposed sewers after treatment in the existing and proposed sewage disposal plants into the waters of Long Island sound and Blind brook, in the village of Rye, at the points indicated on the plans.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *January* 28, 1920

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Trustees of the village of Rye to discharge the sewage from the proposed sewers after treatment in the proposed and existing sewage disposal plants into the waters of Blind brook and Long Island sound at the points indicated on the plans, within the municipality of Rye in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.

2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.

3. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers.

5. That no sewage sludge from any part of the disposal works shall be discharged into Long Island sound, Blind brook, or any other watercourse.

M. NICOLL, JR.

January 28, 1920 — *Deputy State Commissioner of Health*

Plans were approved on July 14, 1920, for modifications and extensions to the sewerage system and disposal works in the Beaver Swamp District of the village of Rye. The permit issued in connection with the approval of these plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Trustees of the village of Rye to discharge effluent from the proposed disposal plant to be constructed in connection with the proposed sewer system in the Beaver Swamp district of said village, into the waters of Beaver Swamp brook at a point about 400 feet from the westerly village line, within the village of Rye, Westchester county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That only sanitary sewage and no storm water or surface water from streets, roofs or other areas shall be admitted to the proposed sewers and sewage disposal works.

2. That sludge and scum shall not be permitted to accumulate in any settling tank to such an extent as to occupy more than one-fifth of normal liquid capacity of such tank.

3. That the sludge and scum from the primary settling tanks shall be removed, transported, and disposed of at some suitable point without the creation of a nuisance, or that such sludge and scum shall be disposed of on suitable sludge drying beds, plans for which shall first have been submitted to and received the approval of this Department before such beds are installed and put in operation.

4. That no sludge, scum, or screenings shall be discharged into any stream or body of water, or so placed as to be carried or washed thereinto by rain or melting snow.

5. That the sludge drip drain from the settling tanks near Davenport street shall be connected with and discharged into the first settling tank.

6. That suitable motors shall be provided to discharge, at normal rate without overloading, 210 gallons per minute to the dosing tank at the sprinklers.

7. That whenever the sewage tributary to the portions of the proposed sewage disposal plant designed to be installed first, shall exceed that contributed by 1,500 persons, additional units shall be added as provided for by the plans approved this day.

M. NICOLL, JR.

July 14, 1920 — *Deputy State Commissioner of Health*

SARANAC LAKE

The following approval of a certification of the recommendation for the construction of a sewer in Winona avenue, in the village of Saranac Lake, was issued on July 9, 1920:

In the matter of the certification of the Board of Health of the village of Saranac Lake and town of Harrietstown (consolidated health district), recommending the construction of a certain sewer.

Whereas, The Board of Health of the village of Saranac Lake and the town of Harrietstown (consolidated health district), acting under the provisions of section 21-a of the Public Health Law, have deemed the sewers of the village of Saranac Lake insufficient properly and safely to sewer said village, and have certified this fact to me in writing, with its reasons therefore; stating and recommending what additions should in the judgment of such Board of Health be made, namely, the construction of a sewer in Winona avenue to discharge into the existing sewer at the foot of Winona avenue; and

Whereas, Such recommendations and the reasons therefor for the construction of said sewer and appurtenances have been carefully considered and meet with my approval;

Now, therefore, I, M. Nicoll, Jr., Deputy State Commissioner of Health, acting under the authority vested in me by section 21-a of the Public Health Law, as amended by chapter 559 of the Laws of 1913, do hereby approve said recommendations on this 9th day of July, 1920.

M. NICOLL, JR.
Albany, N. Y. *Deputy State Commissioner of Health*

SCOTIA

Plans were approved on March 3, 1920, for proposed sewer extensions in Exchange, Hetherington, and Veeder streets, in the village of Scotia. The permit issued in connection with the approval of the plans contained only the usual revocation, modification, complete construction, and storm water clauses.

SHANDAKEN (Town) (Chichester)

Plans for the proposed sewerage system and disposal plant at the unincorporated village of Chichester, in the town of Shandaken, Ulster county, were submitted to this Department for approval on July 22, 1920, by the Commissioner of Water Supply, Gas and Electricity of the city of New York. The report upon the examination of the plans follows:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an examination of plans for the proposed sewerage system and disposal plant at the unincorporated village of Chichester, in the town of Shandaken, Ulster county, N. Y., submitted with a report and application for approval of these plans by the Commissioner of Water Supply, Gas and Electricity of the city of New York on July 22, 1920.

Department Records

The records of the Health Department of the State of New York show that on January 30, 1920, the chief engineer of the New York City Department of Water Supply, Gas and Electricity was advised that the plans for this work must be submitted to the State Department of Health for approval, in accordance with article V of the Public Health Law, and that on June 1, 1920, two engineers from the city department conferred with the Chief Engineer of the Health Department on preliminary plans for the disposal of the sewage of Chichester by sedimentation and subsurface irrigation; and further, that a conference was held on the grounds where the proposed works are planned to be installed, by an engineer from the Health Department and the city department on August 7, 1920.

Earlier Records

The Health Department records also show that previous to this time sewage disposal provisions were maintained by the city of New York at the factory of W. O. Schwarzwaelder, at Chichester, which were inspected by a representative of the State Health Department in the spring of 1917. They further show that the advice of the Deputy Commissioner of Health on sanitary provisions for the vicinity in question, sought by the Deputy Commissioner of Water Supply, Gas and Electricity, was given by letter on December 8, 1919.

General Location

The manufacturing hamlet of Chichester is situated at the confluence of Ox Clove stream and Warnerkill, about 2 miles above where the latter, which is called Stony Clove on the plans and United States geologic sheets, empties into the Esopus creek. The hamlet is located in the upper mountainous part of Ulster county, about 1 mile south of the Greene county line, on the Stony Clove and Kaaterskill branch of the Ulster and Delaware railroad, 25 miles by rail northwesterly from the city of Kingston on the Hudson. The population of Chichester itself, prior to the last census, is given as 218 persons. The population contained in town and county both appears to have remained about stationary since 1875.

Engineer's Report, Historical

The report of the engineer of the city department states as follows: "The unincorporated village of Chichester lies within the watershed of Esopus creek, from which watershed New York city obtains more than half its present supply. The village is really built around and owes its existence to a furniture factory owned and operated by William Schwarzwaelder and Company, Inc. The owners and managers of this industry live in houses located more or less at random on the company's property, while some of the operatives live in company owned houses located generally along the public highway. Two streams, the Warnerkill or Stony Clove, and the Ox Clove, unite just below the village.

Engineer's Report, Sanitation

"Of about forty buildings in the village, eight houses, one store, one office, and one stable are provided with running water and inside toilet fixtures which discharge sewage and household wastes directly into the streams mentioned above. Chemical closets installed in the factory in 1918 by the Board of Water Supply, city of New York, and now maintained by the Department of Water Supply, Gas and Electricity, provide toilet facilities for the factory operatives. The buildings not provided with inside fixtures depend on pit privies for fecal wastes. The water supply for the village comes from a small reservoir located on the Ox Clove north of the village. A system of hydrants provide fire protection. The water supply is abundant except during periods of drought or extreme cold weather. Test pits excavated at several points in the disposal field indicated a gravelly formation admirably suited for the absorption of the effluent from the dosing tank. The disposal field will be operated by the Department of Water Supply, city of New York, an employee visiting the plant at regular intervals to note general conditions and to operate the mechanical devices controlling delivery of sewage to the different sections of tile field."

General Purpose of Design

The following outline is included in the general description given by the report of the engineer for the city department: The purpose of the proposed construction is to collect all waterborne sewage and household wastes in a small sewerage system of the separate type, and dispose of same by subsurface irrigation through a tile field located on suitable ground below the village. Until such time as water supply, inside fixtures, etc., are installed in the factory, that building must continue to use the chemical closets. The system as laid out can be readily extended for connecting with buildings not at present equipped for delivering waterborne sewage. Briefly, the design calls for a simple collecting system which will deliver the sewage to a concrete sedimentation tank, this structure to be divided into two parts, one to act as a settling basin, the other as a dosing tank. The contents of the dosing tank will be discharged through an automatic syphon into a system of 6-inch subsurface tiles arranged in sections for use in rotation.

Basis of Design

This gives design assumptions as follows:

Source of Daily Contribution	*Gallons*
10 tributary buildings, mostly residences, at 300 gallons	3,000
1 factory and office, toilets only, 100 persons, at 20 gallons	2,000
20 future fixtures, where system is in use	1,000
Total daily rate, about 800 cubic feet, or	6,000

Persons provided for in foregoing	150
Capacity settlement tank, about 2½ hrs. total flow, cu. ft.	80
Digestion tank, below slot, about 2 cu. ft. per capita, cu. ft.	290
Dosing tank, about 8 hrs. flow, capacity, cu. ft.	200
Subsurface tile, 20 ft. each for 150 persons, 3 units	3,000
Estimated cost of work planned and specified	$16,000

General Field Inspection

In inspection on the field by one of our engineers showed that the raceway from the mill to below the private road, a distance of about 500 feet, instead of being open was used as a covered general sewer at the discharge end of which evidence of such use was most apparent. The city maintains a chlorinating station on the Esopus just below the hamlet of Phoenicia, which with a population of 350 lies 2 miles south of Chichester at the confluence of Stony Clove stream with the Esopus. About 6 miles farther down the Ashokan reservoir provides a storage detention of about 6 months, while as a further precaution the water entering the aqueduct to the city is subjected to constant bacteriological and chemical examination.

Scope of Plans

The plans now submitted show the building sites to be located along Stony Clove and Ox Clove streams in such form as to be within an equilateral triangle with legs 1,600 feet long north of a base line lying east and west along Stony Clove for a distance of about 2,100 feet. The disposal works are in the westmost angle of this triangle at an elevation of 940 feet, while the surface elevation in the other angles is about 1,100 feet. About 64 buildings are indicated on the general plan. Of these,. immediate connection appears feasible for 27 houses, and for about 11 future connections seem provided. Eleven houses or buildings seem left without indicated provision, but at sufficient elevations to connect, and another 11 seem to be very small but in positions which enable connections from them to be made to the general system. Only four houses shown on the plans appear to be too low for future gravity connection to be easily made although three of these four can be reached by a 600 foot extension.

Detailed Examination

The plans and the site of the works in the field have been carefully examined with respect to the sewerage systems and sewage disposal works. In connection with the sewerage system, the design has been carefully studied with reference to alignment, sizes, grades, capacities, facilities for cleaning and inspection and flushing, and other features of a hydraulic or sanitary nature. In connection with means for sewage disposal, it has been studied with reference to general location, method and efficiency of the sewage disposal plant as a whole, and of the capacities and practical operation of the individual structures, appurtenances, and apparatus.

Sewer Location

The alignment of the sewer is so chosen as to escape deep cutting. Of the entire system only about 200 feet is more than 10 feet beneath the surface. Although the narrow but important highway from Kingston, Ashokan, and Phoenicia to Zanesville, Hunter, and Tannersville passes through the center of the hamlet, and a private road is shown running from it along Ox Clove to most of the houses not on this highway; and although as a general public policy with a view to ultimate ownership it is usually desirable to locate sewers in streets or roads, this sewer system appears to be largely located through private land. This location seems probably permissible, however, in this case, on account of the narrowness and constant use of the road and other local conditions. It seems to be explained by the statement in the engineer's report concerning the managers and operatives living on properties now owned collectively by the present factory owners. The sanitary rights and rights of way of the city are also reported to be more definitely and completely covered in a permanent right of way and maintenance agreement with the land owners.

Sewer System

The main sewer is of 8-inch vitrified pipe and extends down Stony Clove 1,850 feet from the factory to the treatment tank, from which tank the effluent is carried about 175 feet farther to a subsurface irrigation field. A 6-inch branch running northward 740 feet near the confluence of Stony and Ox Clove provides for the buildings near the north angle of the triangle near the building site. From near the factory, two 6-inch future extensions are shown — one extending northerly 380 feet to provide for a garage and two other buildings, the other extending easterly 620 feet to provide for 8 buildings at the eastern extremity of the triangle. The vitrified pipe shown passing over the tailrace under the factory building should be changed to an iron pipe.

Sewer Grades and Appurtenances

The lightest slope in the main 8-inch sewer is 0.5 per cent, which should be sufficient to produce a self-cleansing velocity. The little likelihood of any very great extensions in the near future, together with the excellent slopes attainable and short lengths, makes the small size of the 6-inch branch and extension appear permissible. The 5-inch house connections afford additional opportunities for flushing beside that arranged for in a permanent agreement with the factory proprietors, and that provided by manholes which are shown at all terminals and deflections in the sewer and are nowhere more than 400 feet apart. The castiron pipe under the two creek crossings and the vitrified pipe bends in drop manholes are shown bedded in concrete.

Location of Disposal Plant

The site for the disposal works is chosen in what appears from the United States topographic map to be relatively flat bottom land below the hamlet and between Stony Clove stream and the adjoining highway and the railroad, which seem to parallel the former at a distance of about 500 feet from it. The railroad and contours of the disposal field are not shown on the plans submitted. These plans, however, show the treatment tank to be located about 110 feet from a church. The subsurface tile field is to be within 75 feet of a house located where a branch road from the direction of the railroad enters the main road, so that it is important that the plant shall be so constructed, maintained, and operated as to prevent the creation of objectionable odors, and unusual attention and provisions to facilitate examination and cleaning are desirable. That portion of the disposal field which is to be at once underfed by subsurface irrigation pipes, is to be 15 feet from the main highway and about 30 feet from the bank of a stream. That distance is less than such rules as rule 10 of the regulations for the protection of the city's water supply might be interpreted to allow; but as the distance to the usual flow line of the stream is about 100 feet it seems permissible.

Inspection of Disposal Location

The main highway runs along the north side of this flat on a bank about 10 feet or 15 feet above the adjoining creek, while on the other side of the disposal site the ground rises on a slope of about 15 per cent to the railroad, with however a small ditch between which diverts most of the hill water from the flat. The church is at the easterly and most used end of the flat, while on the westerly end is the house previously mentioned as the only one not provided for by gravity. On the side road near this house are one or two more houses, and several others are on the main road below the disposal site. The only water supply for these houses is from outside community hydrants, and separate disposal plants may be provided when necessary.

Field Inspection of Disposal Site

The field examination of the disposal site showed it to be located on a flat or area of bottom land about 500 feet long by 200 feet wide, which is in frequent use as a ball field by the people of the hamlet. The probable use of the tank covers and surrounding ground for a standing place for smokers and others watching ball games makes the installation of proper ventilation for the settling tank, and a fence around the covers or their further strengthening, essential. It is stated in the report that test pits indicated a gravelly formation, but no water levels or grain sizes were given and no samples of soil furnished. Test pits on the location of the lower unit of subsurface tile showed 14 inches of loam followed by gravel and boulders growing more sandy as the depth increased to about 4 feet. Previous tests in April were reported as showing water at a depth of about 5 feet below the surface in a pit near the west end of the field.

Disposal Tank Details

The treatment tank is to be of the two-story type. It is to be built of concrete and will consist of an outer tank 7 feet long by 8 feet wide with vertical walls 18 inches thick extending 9 feet below water line, at which depth they terminate in a hopper bottom 2 feet deep and from 10½ inches to 12 inches thick. In the upper portion of the tank is to be placed an inner compartment or sedimentation trough 3 feet 8 inches wide at the top, which extends the length of the tank. The walls of the trough are of 4-inch reinforced concrete extending vertically 1 foot 6 inches below water line, after which they converge to a 4-inch bottom slot at a farther depth of about 2 feet 8 inches. It is customary and a satisfactory practice for this slot to be made 6 inches wide, and it is recommended that this change in width be made, as trouble, such as the bridging of gelatinous matter and large solids, has been frequently experienced with smaller openings.

Tank Capacity

The settling trough has a capacity of 623 gallons, or 0.55 cubic feet per capita for 150 persons; or if a rate of 40 gallons per capita per day be considered, a detention period of 2½ hours at this average rate of flow. The available sludge capacity of the main tank taken under a plane 1 foot below the slot is 252 cubic feet, or 1,890 gallons, giving an apparently satisfactory storage capacity of 1.7 cubic feet or 12.6 gallons per capita. It is usual to assume water consumption at 100 gallons per capita, instead of 40 gallons used by the engineer for the city department. Small hamlets are occasionally found where a water consumption as low as 40 or 50 obtains, but as this generally rapidly increases after facilities for getting rid of sewage are furnished, a larger assumption than 40 gallons is usual. However, on account of the responsible care and feasibility of duplicating this tank if necessary, its present dimensions appear satisfactory.

Facilities for Inspection and Cleaning

On the same sheet which covers the disposal works and details drawn on a scale 1/10 that marked thereon, the treatment tank is shown, covered by 5 concrete slabs reinforced by twisted bars ½-inch square on 6-inch centers, shown longitudinally placed about 1 inch from both the top and bottom and shown transversely close to the center. These slabs are each about 8 feet long by 2 feet 2 inches wide and 6 inches thick, and are each furnished with 2 steel handles. As these slabs were stated to be provided in expectation of their use for standing upon by an assemblage of people, for which purpose, particularly considering possible injury in handling, the factor of safety used seems none too great; and as slabs of the width shown would each weigh 1,200 to 1,500 pounds, it is suggested that means for easily and carefully handling them be furnished and maintained closely at hand, and that they be carefully made and kept in condition to sustain exposure, handling, and the load of crowds of persons in motion; or that means be provided in some part for each tank or manhole to simplify examination, adjustment, and maintenance, and that this object be held in view in the design of the gate and cover, not shown, for the tile field control gate chamber or distribution manhole, which is specified as to be furnished by the city.

Flow Through Settling Tank

The outfall sewer is shown to enter the settling trough with its invert grade level with the top of the sewage in the trough. The outlet from the settling trough into the dosing chamber is protected with a vertical screen extending 18 inches below the surface about a foot from the wall, but the outfall sewer ends flush with the end wall of the tank and is neither turned down into an iron T nor submerged discharge, nor provided with a scum board or baffle slightly offset from the end to prevent any sewage discharge on top of the scum and to give it a wide distribution. It is therefore recommended that the latter of these provisions be made, to ensure better circulation of the sewage.

Dosing Chamber

The dosing chamber, which the sewage enters over a 24-inch weir, is 7 feet wide by 11 feet long in plan and has a hydraulic depth of 2 feet 11 inches. It is of concrete, with 12-inch walls and a level 8-inch bottom. The end wall thickness below the water line is reduced to 8 inches for a width of 2 feet. Above this reduced panel is shown a rectangular opening about 14 inches high which will provide a means for the effluent automatically to reach the subsurface irrigation field in case the 6-inch siphon, with which the chamber is shown equipped, fails to work.

Dosing Capacity

The siphon bell is placed about 4 inches above the floor at one end, and its air inlet pipe about 6 inches above the floor. The hydraulic content of the dosing chamber above this inlet is about 187 cubic feet or 1,400 gallons, which seems satisfactory in view of the capacity of each of the 3 units of 1,000 feet each of 6-inch open joint tile into which the subsurface system is divided. These tile units, when clean, have a liquid capacity of over 1,470 gallons. It is suggested, however, that the bottom of the dosing chamber be sloped to facilitate cleaning, as otherwise an average excess of over six inches of more or less odorous sludge will collect and remain in the bottom. It is further suggested that the siphon be placed in a sump about 5 or 6 inches in depth so as to drain more completely the chamber.

Automatic Siphon

The 6-inch sewage effluent siphon shown is shown by the manufacturer's catalogue to have an average discharge rate of 1.06 second foot through its operation when emptying a 40-gallon flush tank with an incipient head of 3 feet 8 inches. The maximum hydraulic gradient shown from the effluent surface to the pipe invert is 3 feet 6 inches, which appears to give an incipient discharge rate of about 3 second feet, or a discharge rate of nearly 2 second feet when the 8-inch outlet pipe to the distribution lines is flowing full to its maximum capacity. Since the capacity of the 8-inch effluent pipe on its ½ per cent grade shown is about 4/5 of a second foot, the discharge of the siphon will be somewhat retarded, but as care is taken to maintain sufficient net head to operate the siphon this retardation of discharge and operation of the effluent pipe under a slight pressure appears permissible.

Effluent Outfall

The outlet manhole into which the effluent siphon discharges is 2 feet by 3 feet in plan and is of concrete, with 9-inch walls attached to the end of the dosing chamber and drained by the 8-inch effluent pipe previously mentioned. This effluent pipe is shown to have its invert at elevation 939 at this manhole, which with its scaled length of 175 feet and grade of ½ per cent would give its invert an elevation of 938.12 at the gate chamber or control manhole. The upper portion of the subsurface tile lines, therefore, appears to have an invert elevation slightly lower than 938, while the adjacent stream bed is indicated to have an elevation of about 925, further indicating that care must be taken to prevent seepage through the bank of the stream and uneven distribution by too great a rush to the ends of the subsurface tile. It is therefore suggested that their slopes, which are not specified, be made not greater than 5 or 6 inches in 100 feet.

Subsurface Irrigation

The information regarding the subsoil irrigation field is far from being as full as might be desired, there being no spacing of lines and distributing tile shown, nor are sections of distributors nor details of gates and branch lines shown. The whole system is shown in plan only, and on a space less than 3 inches square without any indication of the slopes of the field or the slopes on which the 6-inch subsurface tile and 8-inch feeders are to be laid, unless the slopes stated by the report as adopted for these sizes of pipe be taken which slopes would be about twice too much if applied to subsurface irrigation piping. It is therefore recommended that such essential details be shown. It cannot be assured in advance that in soil containing the percentage of loam present in that of the disposal field, 20 feet of tile per capita will suffice even if the exceptionally small use of water continues. For this reason it is suggested that advantage be taken at this time, when a contractor is to be present with labor equipment, to lay advantageously additional tile, even though it be found later that they are not needed at once, but may be held in reserve for subsequent use when the population sewered is increased or the soil around the present tile become saturated and clogged.

Sludge Piping

No wash water supply is shown, and the sludge pipe of the settling tank is shown only in profile. It is of 6-inch B. & S. C. I., which size, instead of the usual size of 8-inches or larger, seems permissible on account of the small size of the unit and the care and attention likely to obtain. The sludge pipe is without support for its lower section other than such temporary strength as the builder may give through the calking of the bell of its lower joint, and at the joints of the Y branch to which the lower joint hangs. The sludge is shown as let into the sludge manhole at the bottom of the latter by a shear gate in the sludge pipe. Such a gate as ordinarily installed and operated would not suffice to retard the infiltration of sewage from the tank, and the creation of a nuisance at this point might result. It is therefore recommended that the sludge pipe be firmly supported, and that a gate valve be used at its outlet, and that consideration be given to making some convenient provision for a connection from a hydrant.

Sludge Disposal

The sludge manhole is constructed of concrete, with 9-inch walls and 6-inch bottom, and has a monolithic inset reinforced slab cover weighing nearly a ton. The maximum hydraulic capacity of the sludge manhole is 60 cubic feet, but under normal operation — as it will continually decrease, lowering the level of the main tank about 0.95 feet, even in its first filling — its useful maximum capacity appears to be about 48¾ cubic feet, or less than ⅕ of the sludge capacity of the main tank. No outlet is shown from the sludge manhole, or is any apparatus for or method of removal, treatment or disposal of sludge described. It appears from the elevation that several hundred feet of pipe would be required to convey the sludge to a sludge filter. It seems essential to an understanding of the project to have some statement or plan covering the removal, conveyance, and disposal of the sludge before finally considering the plans.

Recommendations

It is therefore recommended that the plans be returned for amplification and modifications along the lines suggested, including the following:

1. That the reason for not locating the sewers on roads, and that the methods of operation and sludge disposal be fully stated.
2. That the spacing of the tile subsurface pipes, details of the connections of the branches to the main distributors and manner of covering their joints as well as their slopes be shown, so that these important features of the design may be understood.
3. That to lessen the danger of clogging the slot in the bottom of the sedimentation trough be made 6 inches in width; and further, that either a baffle be placed near the inlet to the settling trough or other means provided for securing better distribution of flow.
4. That a strong bracket of wroughtiron heavily coated with tar, or other satisfactory method of supporting the bottom of the sludge pipe, be shown; and that a gate valve be placed at its discharge end to lessen any danger of seepage of sewage into the sludge manhole.

Respectfully submitted
THEODORE HORTON
ALBANY, N. Y., *August* 13, 1920 *Chief Engineer*

The revised plans were submitted for approval on September 3, 1920. An examination of the plans showed that they were revised in general accordance with the recommendations of the above report. The plans were approved on September 22, 1920. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Department of Water Supply, Gas and Electricity of the city of New York to discharge effluent from the proposed sewage disposal plant to be constructed by said Department at Chichester, into the ground waters tributary to the Stony Clove branch of Esopus creek, within the town of Shandaken, Ulster county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That the sewer system and the sewage disposal works shown by the plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof except that the slopes of subsurface laterals shall not exceed one-half of 1 per cent.
2. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewer system and sewage disposal works.
3. That no sewage sludge from any part of the disposal works shall be discharged into the Stony Clove branch of Esopus creek or any other watercourse or body of surface water, or be deposited on the ground where it may be washed by rain or melting snow into any watercourse or body of surface water.
4. That when necessary the sludge shall be removed from the proposed tank and disposed of by burying in such a manner as not to create a nuisance.

5. That whenever required by the State Commissioner of Health, the proposed sewage disposal plant shall be enlarged or extended or that some other satisfactory method of disposal of the sewage from this community be provided under and in accordance with plans which must first be submitted to and receive the approval of this Department.

M. NICOLL, JR.
Acting State Commissioner of Health

September 22, 1920

STONY POINT (Town) (Tompkins Cove High School)

Plans were approved on August 18, 1920, for a proposed sewage disposal plant for the Tompkins Cove High School, in the town of Stony Point, Rockland county. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Board of Education of School District No. 5, town of Stony Point to discharge the effluent from the proposed sewage disposal plant to serve the Tompkins Cove High School in said school district into the ground waters tributary to the Hudson river, within the town of Stony Point, Rockland county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That the seepage trench be terminated at no less distance than 6 feet from the adjoining property.
2. That the treatment tank and trench be so placed as not to contaminate any well or source of water supply.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal works.
4. That no sewage sludge from any part of the disposal works shall be discharged into the blind ditch or into any watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.
5. That whenever required by the State Commissioner of Health, satisfactory detailed plans for extension to the disposal plant or additional works for more complete treatment of the sewage of the disposal plant of the school shall be submitted for approval; and upon the approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.
Deputy State Commissioner of Health

August 18, 1920

SYRACUSE

Plans were approved on September 2, 1920, for the extension from Spencer street to Hiawatha street of the existing main intercepting sewer of the city of Syracuse. The report upon the examination of the plans, together with the permit issued in connection with the approval of the plans, follow:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on our examination of plans for the extension from Spencer street to Hiawatha street of the existing main inter-

cepting sewer of the city of Syracuse, Onondaga county, submitted to this Department for approval by the Syracuse Intercepting Sewer Board on August 27, 1920.

General

Syracuse is located in the central part of Onondaga county at the southeasterly end of Onondaga lake. All but a relatively small area of about 600 acres in the southeastern section of the city drains into Onondaga lake through Onondaga creek, Harbor brook, and Ley creek. Most of the city, however, drains into Onondaga creek which flows in a northerly direction through the central part of the city. The old Erie canal extends through the city from west to east, and one of the terminals or harbors of the State Barge canal is situated on Onondaga creek in the north central part of the city.

The city of Syracuse has an area of about 11.500 acres and a population of about 172,000, giving an average density of population from the entire area of approximately 15 persons per acre. The actual density of population, however, varies from 2 to 70 persons per acre. The population tributary to the public sewer system and intercepting sewers is estimated at 158,000. The remainder of the population is not reached by the existing sewers and is provided with privies and cesspools.

The water supply of the city is derived from Skaneateles lake and is delivered to the city by gravity. The water is sterilized with liquid chlorine at certain seasons of the year. The present water consumption is approximately 26,000,000 gallons per day, and it is estimated that about 160,000 persons are supplied with the public water supply.

According to data submitted by the Intercepting Sewer Board, the present average dry weather flow of sewage tributary to the intercepting sewers is 22.62 million gallons per day, equal to a per capita rate of sewage contribution of 143 gallons per day. The present average flow of sewage, which includes storm water, is estimated at 30.37 million gallons per day, equal to a daily per capita rate of sewage contribution of 191 gallons. The population that will be tributary to the intercepting sewers of the city in 1940 is estimated at 220,000 gallons, and the average dry weather flow of sewage in 1940 is estimated at 27.52 million gallons per day, equal to a per capita rate of sewage flow of 125 gallons per day. The average rate of sewage flow in 1940 is estimated at 35.27 million gallons per day, equal to a rate of sewage flow of 160 gallons per capita per day.

With the exception of a small section in the northeastern part of the city having an area of about 600 acres, practically the entire city is sewered on the combined plan. Most of the sewers of the city have been constructed in general accordance with plans prepared by Samuel M. Gray of Providence, in 1895. The socalled Gray plans were adopted as the official map of the city of Syracuse under chapter 542 of the Laws of 1907. Certain modifications have been made in these plans by the Intercepting Sewer Board established by chapter 356 of the Laws of 1907. In this connection it may be noted that except for plans for sanitary sewers in the socalled Huntley tract, and for certain sanitary sewers in the 17th ward of the city, approved by this Department in 1915, plans for none of the sewers constructed in the city have been submitted to and received the approval of this Department before their construction.

The socalled Gray plans provided for the construction of combined sewers in all but the socalled Huntley tract in the northeastern section of the city tributary to Ley creek, and for the ultimate interception and concentration of the sewage tributary to these sewers at Hiawatha street. That objectionable conditions would be created by the discharge of sewage from these sewers into Onondaga creek and Harbor brook, and ultimately into Onondaga lake, and the need for the interception and the treatment of the sewage of the city, were recognized by Mr. Gray. In fact, he pointed out that even in 1894 the dilution afforded by Onondaga creek and Harbor brook was inadequate to prevent the creation of a nuisance in these streams, and accordingly designed plans for the interception of the sewage tributary to these streams and for the discharge of the sewage intercepted into Onondaga creek to Hiawatha street, near the lake.

The lateral sewers of the city which have been constructed in general accordance with the Gray plans, were designed to care for all of the sanitary or domestic sewage of the city tributary to Onondaga lake, and for rainfalls of from ½ to ¾ inches per hour. They were planned to discharge into Onondaga creek and Harbor brook at the foot of nearly every street leading to these streams. The plans prepared by Mr. Gray for intercepting sewers along Onondaga creek and Harbor brook have been modified somewhat by the Intercepting Sewer Board. These sewers as finally constructed were planned to care for a maximum flow of sewage from an ultimate future population of about 400,000, which it is expected will be reached in about 70 years, and in addition an amount of storm water equivalent to this flow of sewage being estimated at 187.5 gallons per day. In estimating the dry weather flow it was assumed that the ultimate average flow of domestic sewage will be 125 gallons per day, and that the maximum rate of flow will be 50 per cent greater than the average flow. The intercepting sewers have therefore a combined capacity of approximately 150,000,000 gallons per day, equal to about six times the present dry weather flow of sewage.

The sewage collected by the sewers of the city formerly discharged into Onondaga creek and Harbor brook through numerous outlets. In order to relieve the insanitary conditions created by the discharge of sewage into these streams, the Syracuse Intercepting Sewer Board improved and in certain sections lowered the channel of Onondaga creek and constructed the present intercepting system of sewers. These sewers now discharge into Onondaga creek near Spencer street and near Hiawatha street. These intercepting sewers provide for the interception of all of the dry weather flow from the lateral sewers and for the storm water up to the capacity of the intercepting sewers. The excess flow of sewage is discharged through regulated overflows at the points where the lateral sewers are intercepted by the intercepting sewers.

Thus it will be seen that the intercepting sewers are expected to care for an amount of storm water equal to about five times the present dry weather flow, but that ultimately, when the population reaches 400,000, they will care for only twice the maximum dry weather flow of sewage. Although it is not stated how frequently the lateral sewers will overflow into Onondaga creek and Harbor brook as a result of the limited capacity of the intercepting sewers, it is obvious, with a combined capacity of the two intercepting sewers of only 150,000,000 gallons per day, which is equivalent to about .025 inch of rainfall per hour over the area served by these sewers, that overflowing of combined sewage will occur frequently at the present time, and increasingly more so in the future as the ultimate population is reached.

The main intercepting sewer varies in size from 24- to 90-inches in diameter, and at present discharges into Onondaga creek near Spencer street above the Barge canal harbor. The socalled Harbor brook intercepting sewer varies in size from 18 to 54-inches in diameter, and discharges into Onondaga creek at Hiawatha street below the Barge canal harbor. The discharge of sewage and the deposits of sludge into Barge canal harbor has created a serious nuisance. In order to remedy this condition, the city is now planning to extend the intercepting sewer to the point below the harbor and finally to treat this sewage collected by the intercepting sewers in a sewage disposal plant to be located north of Hiawatha street, and to discharge the effluent into Onondaga lake through multiple outlets about 1,300 feet from the shore.

Plans now submitted provide for the extension of the existing main intercepting sewer from its point of discharge into Onondaga creek at Spencer street to the proposed disposal plant at Hiawatha street, about 5,000 feet from Spencer street, and for the interception of the existing Harbor brook existing sewer at Hiawatha street. General tentative plans for the disposal of the sewage have also been submitted, but these plans have not been worked out in detail, and since it is the desire that earliest possible action be taken by the Department upon the intercepting sewer extension from Spencer street to the

Earlier Records

The Health Department records also show that previous to this time sewage disposal provisions were maintained by the city of New York at the factory of W. O. Schwarzwaelder, at Chichester, which were inspected by a representative of the State Health Department in the spring of 1917. They further show that the advice of the Deputy Commissioner of Health on sanitary provisions for the vicinity in question, sought by the Deputy Commissioner of Water Supply, Gas and Electricity, was given by letter on December 8, 1919.

General Location

The manufacturing hamlet of Chichester is situated at the confluence of Ox Clove stream and Warnerkill, about 2 miles above where the latter, which is called Stony Clove on the plans and United States geologic sheets, empties into the Esopus creek. The hamlet is located in the upper mountainous part of Ulster county, about 1 mile south of the Greene county line, on the Stony Clove and Kaaterskill branch of the Ulster and Delaware railroad, 25 miles by rail northwesterly from the city of Kingston on the Hudson. The population of Chichester itself, prior to the last census, is given as 218 persons. The population contained in town and county both appears to have remained about stationary since 1875.

Engineer's Report, Historical

The report of the engineer of the city department states as follows: " The unincorporated village of Chichester lies within the watershed of Esopus creek, from which watershed New York city obtains more than half its present supply. The village is really built around and owes its existence to a furniture factory owned and operated by William Schwarzwaelder and Company, Inc. The owners and managers of this industry live in houses located more or less at random on the company's property, while some of the operatives live in company owned houses located generally along the public highway. Two streams, the Warnerkill or Stony Clove, and the Ox Clove, unite just below the village.

Engineer's Report, Sanitation

"Of about forty buildings in the village, eight houses, one store, one office, and one stable are provided with running water and inside toilet fixtures which discharge sewage and household wastes directly into the streams mentioned above. Chemical closets installed in the factory in 1918 by the Board of Water Supply, city of New York, and now maintained by the Department of Water Supply, Gas and Electricity, provide toilet facilities for the factory operatives. The buildings not provided with inside fixtures depend on pit privies for fecal wastes. The water supply for the village comes from a small reservoir located on the Ox Clove north of the village. A system of hydrants provide fire protection. The water supply is abundant except during periods of drought or extreme cold weather. Test pits excavated at several points in the disposal field indicated a gravelly formation admirably suited for the absorption of the effluent from the dosing tank. The disposal field will be operated by the Department of Water Supply, city of New York, an employee visiting the plant at regular intervals to note general conditions and to operate the mechanical devices controlling delivery of sewage to the different sections of tile field."

General Purpose of Design

The following outline is included in the general description given by the report of the engineer for the city department: The purpose of the proposed construction is to collect all waterborne sewage and household wastes in a small sewerage system of the separate type, and dispose of same by subsurface irrigation through a tile field located on suitable ground below the village. Until such time as water supply, inside fixtures, etc., are installed in the factory, that building must continue to use the chemical closets. The system as laid out can be readily extended for connecting with buildings not at present equipped for delivering waterborne sewage. Briefly, the design calls for a simple collecting system which will deliver the sewage to a concrete sedimentation tank, this structure to be divided into two parts, one to act as a settling basin, the other as a dosing tank. The contents of the dosing tank will be discharged through an automatic syphon into a system of 6-inch subsurface tiles arranged in sections for use in rotation.

Basis of Design

This gives design assumptions as follows:

Source of Daily Contribution	*Gallons*
10 tributary buildings, mostly residences, at 300 gallons	3,000
1 factory and office, toilets only, 100 persons, at 20 gallons	2,000
20 future fixtures, where system is in use	1,000
Total daily rate, about 800 cubic feet, or	6,000
Persons provided for in foregoing	150
Capacity settlement tank, about 2½ hrs. total flow, cu. ft.	80
Digestion tank, below slot, about 2 cu. ft. per capita, cu. ft.	290
Dosing tank, about 8 hrs. flow, capacity, cu. ft.	200
Subsurface tile, 20 ft. each for 150 persons, 3 units	3,000
Estimated cost of work planned and specified	$16,000

General Field Inspection

In inspection on the field by one of our engineers showed that the raceway from the mill to below the private road, a distance of about 500 feet, instead of being open was used as a covered general sewer at the discharge end of which evidence of such use was most apparent. The city maintains a chlorinating station on the Esopus just below the hamlet of Phoenicia, which with a population of 350 lies 2 miles south of Chichester at the confluence of Stony Clove stream with the Esopus. About 6 miles farther down the Ashokan reservoir provides a storage detention of about 6 months, while as a further precaution the water entering the aqueduct to the city is subjected to constant bacteriological and chemical examination.

Scope of Plans

The plans now submitted show the building sites to be located along Stony Clove and Ox Clove streams in such form as to be within an equilateral triangle with legs 1,600 feet long north of a base line lying east and west along Stony Clove for a distance of about 2,100 feet. The disposal works are in the westmost angle of this triangle at an elevation of 940 feet, while the surface elevation in the other angles is about 1,100 feet. About 64 buildings are indicated on the general plan. Of these,. immediate connection appears feasible for 27 houses, and for about 11 future connections seem provided. Eleven houses or buildings seem left without indicated provision, but at sufficient elevations to connect, and another 11 seem to be very small but in positions which enable connections from them to be made to the general system. Only four houses shown on the plans appear to be too low for future gravity connection to be easily made although three of these four can be reached by a 600 foot extension.

Detailed Examination

The plans and the site of the works in the field have been carefully examined with respect to the sewerage systems and sewage disposal works. In connection with the sewerage system, the design has been carefully studied with reference to alignment, sizes, grades, capacities, facilities for cleaning and inspection and flushing, and other features of a hydraulic or sanitary nature. In connection with means for sewage disposal, it has been studied with reference to general location, method and efficiency of the sewage disposal plant as a whole, and of the capacities and practical operation of the individual structures, appurtenances, and apparatus.

Sewer Location

The alignment of the sewer is so chosen as to escape deep cutting. Of the entire system only about 200 feet is more than 10 feet beneath the surface. Although the narrow but important highway from Kingston, Ashokan, and Phoenicia to Zanesville, Hunter, and Tannersville passes through the center of the hamlet, and a private road is shown running from it along Ox Clove to most of the houses not on this highway; and although as a general public policy with a view to ultimate ownership it is usually desirable to locate sewers in streets or roads, this sewer system appears to be largely located through private land. This location seems probably permissible, however, in this case, on account of the narrowness and constant use of the road and other local conditions. It seems to be explained by the statement in the engineer's report concerning the managers and operatives living on properties now owned collectively by the present factory owners. The sanitary rights and rights of way of the city are also reported to be more definitely and completely covered in a permanent right of way and maintenance agreement with the land owners.

Sewer System

The main sewer is of 8-inch vitrified pipe and extends down Stony Clove 1,850 feet from the factory to the treatment tank, from which tank the effluent is carried about 175 feet farther to a subsurface irrigation field. A 6-inch branch running northward 740 feet near the confluence of Stony and Ox Clove provides for the buildings near the north angle of the triangle near the building site. From near the factory, two 6-inch future extensions are shown — one extending northerly 380 feet to provide for a garage and two other buildings, the other extending easterly 620 feet to provide for 8 buildings at the eastern extremity of the triangle. The vitrified pipe shown passing over the tailrace under the factory building should be changed to an iron pipe.

Sewer Grades and Appurtenances

The lightest slope in the main 8-inch sewer is 0.5 per cent, which should be sufficient to produce a self-cleansing velocity. The little likelihood of any very great extensions in the near future, together with the excellent slopes attainable and short lengths, makes the small size of the 6-inch branch and extension appear permissible. The 5-inch house connections afford additional opportunities for flushing beside that arranged for in a permanent agreement with the factory proprietors, and that provided by manholes which are shown at all terminals and deflections in the sewer and are nowhere more than 400 feet apart. The castiron pipe under the two creek crossings and the vitrified pipe bends in drop manholes are shown bedded in concrete.

Location of Disposal Plant

The site for the disposal works is chosen in what appears from the United States topographic map to be relatively flat bottom land below the hamlet and between Stony Clove stream and the adjoining highway and the railroad, which seem to parallel the former at a distance of about 500 feet from it. The railroad and contours of the disposal field are not shown on the plans submitted. These plans, however, show the treatment tank to be located about 110 feet from a church. The subsurface tile field is to be within 75 feet of a house located where a branch road from the direction of the railroad enters the main road, so that it is important that the plant shall be so constructed, maintained, and operated as to prevent the creation of objectionable odors, and unusual attention and provisions to facilitate examination and cleaning are desirable. That portion of the disposal field which is to be at once underfed by subsurface irrigation pipes, is to be 15 feet from the main highway and about 30 feet from the bank of a stream. That distance is less than such rules as rule 10 of the regulations for the protection of the city's water supply might be interpreted to allow; but as the distance to the usual flow line of the stream is about 100 feet it seems permissible.

Inspection of Disposal Location

The main highway runs along the north side of this flat on a bank about 10 feet or 15 feet above the adjoining creek, while on the other side of the disposal site the ground rises on a slope of about 15 per cent to the railroad, with however a small ditch between which diverts most of the hill water from the flat. The church is at the easterly and most used end of the flat, while on the westerly end is the house previously mentioned as the only one not provided for by gravity. On the side road near this house are one or two more houses, and several others are on the main road below the disposal site. The only water supply for these houses is from outside community hydrants, and separate disposal plants may be provided when necessary.

Field Inspection of Disposal Site

The field examination of the disposal site showed it to be located on a flat or area of bottom land about 500 feet long by 200 feet wide, which is in frequent use as a ball field by the people of the hamlet. The probable use of the tank covers and surrounding ground for a standing place for smokers and others watching ball games makes the installation of proper ventilation for the settling tank, and a fence around the covers or their further strengthening, essential. It is stated in the report that test pits indicated a gravelly formation, but no water levels or grain sizes were given and no samples of soil furnished. Test pits on the location of the lower unit of subsurface tile showed 14 inches of loam followed by gravel and boulders growing more sandy as the depth increased to about 4 feet. Previous tests in April were reported as showing water at a depth of about 5 feet below the surface in a pit near the west end of the field.

Disposal Tank Details

The treatment tank is to be of the two-story type. It is to be built of concrete and will consist of an outer tank 7 feet long by 8 feet wide with vertical walls 18 inches thick extending 9 feet below water line, at which depth they terminate in a hopper bottom 2 feet deep and from 10½ inches to 12 inches thick. In the upper portion of the tank is to be placed an inner compartment or sedimentation trough 3 feet 8 inches wide at the top, which extends the length of the tank. The walls of the trough are of 4-inch reinforced concrete extending vertically 1 foot 6 inches below water line, after which they converge to a 4-inch bottom slot at a farther depth of about 2 feet 8 inches. It is customary and a satisfactory practice for this slot to be made 6 inches wide, and it is recommended that this change in width be made, as trouble, such as the bridging of gelatinous matter and large solids, has been frequently experienced with smaller openings.

Tank Capacity

The settling trough has a capacity of 623 gallons, or 0.55 cubic feet per capita for 150 persons; or if a rate of 40 gallons per capita per day be considered, a detention period of 2½ hours at this average rate of flow. The available sludge capacity of the main tank taken under a plane 1 foot below the slot is 252 cubic feet, or 1,890 gallons, giving an apparently satisfactory storage capacity of 1.7 cubic feet or 12.6 gallons per capita. It is usual to assume water consumption at 100 gallons per capita, instead of 40 gallons used by the engineer for the city department. Small hamlets are occasionally found where a water consumption as low as 40 or 50 obtains, but as this generally rapidly increases after facilities for getting rid of sewage are furnished, a larger assumption than 40 gallons is usual. However, on account of the responsible care and feasibility of duplicating this tank if necessary, its present dimensions appear satisfactory.

Facilities for Inspection and Cleaning

On the same sheet which covers the disposal works and details drawn on a scale 1/10 that marked thereon, the treatment tank is shown, covered by 5 concrete slabs reinforced by twisted bars ½-inch square on 6-inch centers, shown longitudinally placed about 1 inch from both the top and bottom and shown transversely close to the center. These slabs are each about 8 feet long by 2 feet 2 inches wide and 6 inches thick, and are each furnished with 2 steel handles. As these slabs were stated to be provided in expectation of their use for standing upon by an assemblage of people, for which purpose, particularly considering possible injury in handling, the factor of safety used seems none too great; and as slabs of the width shown would each weigh 1,200 to 1,500 pounds, it is suggested that means for easily and carefully handling them be furnished and maintained closely at hand, and that they be carefully made and kept in condition to sustain exposure, handling, and the load of crowds of persons in motion; or that means be provided in some part for each tank or manhole to simplify examination, adjustment, and maintenance, and that this object be held in view in the design of the gate and cover, not shown, for the tile field control gate chamber or distribution manhole, which is specified as to be furnished by the city.

Flow Through Settling Tank

The outfall sewer is shown to enter the settling trough with its invert grade level with the top of the sewage in the trough. The outlet from the settling trough into the dosing chamber is protected with a vertical screen extending 18 inches below the surface about a foot from the wall, but the outfall sewer ends flush with the end wall of the tank and is neither turned down into an iron T nor submerged discharge, nor provided with a scum board or baffle slightly offset from the end to prevent any sewage discharge on top of the scum and to give it a wide distribution. It is therefore recommended that the latter of these provisions be made, to ensure better circulation of the sewage.

Dosing Chamber

The dosing chamber, which the sewage enters over a 24-inch weir, is 7 feet wide by 11 feet long in plan and has a hydraulic depth of 2 feet 11 inches. It is of concrete, with 12-inch walls and a level 8-inch bottom. The end wall thickness below the water line is reduced to 8 inches for a width of 2 feet. Above this reduced panel is shown a rectangular opening about 14 inches high which will provide a means for the effluent automatically to reach the subsurface irrigation field in case the 6-inch siphon, with which the chamber is shown equipped, fails to work.

Dosing Capacity

The siphon bell is placed about 4 inches above the floor at one end, and its air inlet pipe about 6 inches above the floor. The hydraulic content of the dosing chamber above this inlet is about 187 cubic feet or 1,400 gallons, which seems satisfactory in view of the capacity of each of the 3 units of 1,000 feet each of 6-inch open joint tile into which the subsurface system is divided. These tile units, when clean, have a liquid capacity of over 1,470 gallons. It is suggested, however, that the bottom of the dosing chamber be sloped to facilitate cleaning, as otherwise an average excess of over six inches of more or less odorous sludge will collect and remain in the bottom. It is further suggested that the siphon be placed in a sump about 5 or 6 inches in depth so as to drain more completely the chamber.

Automatic Siphon

The 6-inch sewage effluent siphon shown is shown by the manufacturer's catalogue to have an average discharge rate of 1.06 second foot through its operation when emptying a 40-gallon flush tank with an incipient head of 3 feet 8 inches. The maximum hydraulic gradient shown from the effluent surface to the pipe invert is 3 feet 6 inches, which appears to give an incipient discharge rate of about 3 second feet, or a discharge rate of nearly 2 second feet when the 8-inch outlet pipe to the distribution lines is flowing full to its maximum capacity. Since the capacity of the 8-inch effluent pipe on its ½ per cent grade shown is about 4/5 of a second foot, the discharge of the siphon will be somewhat retarded, but as care is taken to maintain sufficient net head to operate the siphon this retardation of discharge and operation of the effluent pipe under a slight pressure appears permissible.

Effluent Outfall

The outlet manhole into which the effluent siphon discharges is 2 feet by 3 feet in plan and is of concrete, with 9-inch walls attached to the end of the dosing chamber and drained by the 8-inch effluent pipe previously mentioned. This effluent pipe is shown to have its invert at elevation 939 at this manhole, which with its scaled length of 175 feet and grade of ½ per cent would give its invert an elevation of 938.12 at the gate chamber or control manhole. The upper portion of the subsurface tile lines, therefore, appears to have an invert elevation slightly lower than 938, while the adjacent stream bed is indicated to have an elevation of about 925, further indicating that care must be taken to prevent seepage through the bank of the stream and uneven distribution by too great a rush to the ends of the subsurface tile. It is therefore suggested that their slopes, which are not specified, be made not greater than 5 or 6 inches in 100 feet.

Subsurface Irrigation

The information regarding the subsoil irrigation field is far from being as full as might be desired, there being no spacing of lines and distributing tile shown, nor are sections of distributors nor details of gates and branch lines shown. The whole system is shown in plan only, and on a space less than 3 inches square without any indication of the slopes of the field or the slopes on which the 6-inch subsurface tile and 8-inch feeders are to be laid, unless the slopes stated by the report as adopted for these sizes of pipe be taken which slopes would be about twice too much if applied to subsurface irrigation piping. It is therefore recommended that such essential details be shown. It cannot be assured in advance that in soil containing the percentage of loam present in that of the disposal field, 20 feet of tile per capita will suffice even if the exceptionally small use of water continues. For this reason it is suggested that advantage be taken at this time, when a contractor is to be present with labor equipment, to lay advantageously additional tile, even though it be found later that they are not needed at once, but may be held in reserve for subsequent use when the population sewered is increased or the soil around the present tile become saturated and clogged.

Sludge Piping

No wash water supply is shown, and the sludge pipe of the settling tank is shown only in profile. It is of 6-inch B. & S. C. I., which size, instead of the usual size of 8-inches or larger, seems permissible on account of the small size of the unit and the care and attention likely to obtain. The sludge pipe is without support for its lower section other than such temporary strength as the builder may give through the calking of the bell of its lower joint, and at the joints of the Y branch to which the lower joint hangs. The sludge is shown as let into the sludge manhole at the bottom of the latter by a shear gate in the sludge pipe. Such a gate as ordinarily installed and operated would not suffice to retard the infiltration of sewage from the tank, and the creation of a nuisance at this point might result. It is therefore recommended that the sludge pipe be firmly supported, and that a gate valve be used at its outlet, and that consideration be given to making some convenient provision for a connection from a hydrant.

Sludge Disposal

The sludge manhole is constructed of concrete, with 9-inch walls and 6-inch bottom, and has a monolithic inset reinforced slab cover weighing nearly a ton. The maximum hydraulic capacity of the sludge manhole is 60 cubic feet, but under normal operation — as it will continually decrease, lowering the level of the main tank about 0.95 feet, even in its first filling — its useful maximum capacity appears to be about 48¾ cubic feet, or less than ⅙ of the sludge capacity of the main tank. No outlet is shown from the sludge manhole, or is any apparatus for or method of removal, treatment or disposal of sludge described. It appears from the elevation that several hundred feet of pipe would be required to convey the sludge to a sludge filter. It seems essential to an understanding of the project to have some statement or plan covering the removal, conveyance, and disposal of the sludge before finally considering the plans.

Recommendations

It is therefore recommended that the plans be returned for amplification and modifications along the lines suggested, including the following:

1. That the reason for not locating the sewers on roads, and that the methods of operation and sludge disposal be fully stated.
2. That the spacing of the tile subsurface pipes, details of the connections of the branches to the main distributors and manner of covering their joints as well as their slopes be shown, so that these important features of the design may be understood.
3. That to lessen the danger of clogging the slot in the bottom of the sedimentation trough be made 6 inches in width; and further, that either a baffle be placed near the inlet to the settling trough or other means provided for securing better distribution of flow.
4. That a strong bracket of wroughtiron heavily coated with tar, or other satisfactory method of supporting the bottom of the sludge pipe, be shown; and that a gate valve be placed at its discharge end to lessen any danger of seepage of sewage into the sludge manhole.

Respectfully submitted
THEODORE HORTON
ALBANY, N. Y., *August* 13, 1920 *Chief Engineer*

The revised plans were submitted for approval on September 3, 1920. An examination of the plans showed that they were revised in general accordance with the recommendations of the above report. The plans were approved on September 22, 1920. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Department of Water Supply, Gas and Electricity of the city of New York to discharge effluent from the proposed sewage disposal plant to be constructed by said Department at Chichester, into the ground waters tributary to the Stony Clove branch of Esopus creek, within the town of Shandaken, Ulster county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That the sewer system and the sewage disposal works shown by the plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof except that the slopes of subsurface laterals shall not exceed one-half of 1 per cent.
2. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewer system and sewage disposal works.
3. That no sewage sludge from any part of the disposal works shall be discharged into the Stony Clove branch of Esopus creek or any other watercourse or body of surface water, or be deposited on the ground where it may be washed by rain or melting snow into any watercourse or body of surface water.
4. That when necessary the sludge shall be removed from the proposed tank and disposed of by burying in such a manner as not to create a nuisance.

5. That whenever required by the State Commissioner of Health, the proposed sewage disposal plant shall be enlarged or extended or that some other satisfactory method of disposal of the sewage from this community be provided under and in accordance with plans which must first be submitted to and receive the approval of this Department..

M. NICOLL, JR.
September 22, 1920 *Acting State Commissioner of Health*

STONY POINT (Town) (Tompkins Cove High School)

Plans were approved on August 18, 1920, for a proposed sewage disposal plant for the Tompkins Cove High School, in the town of Stony Point, Rockland county. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to Board of Education of School District No. 5, town of Stony Point to discharge the effluent from the proposed sewage disposal plant to serve the Tompkins Cove High School in said school district into the ground waters tributary to the Hudson river, within the town of Stony Point, Rockland county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That the seepage trench be terminated at no less distance than 6 feet from the adjoining property.
2. That the treatment tank and trench be so placed as not to contaminate any well or source of water supply.
3. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal works.
4. That no sewage sludge from any part of the disposal works shall be discharged into the blind ditch or into any watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.
5. That whenever required by the State Commissioner of Health, satisfactory detailed plans for extension to the disposal plant or additional works for more complete treatment of the sewage of the disposal plant of the school shall be submitted for approval; and upon the approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.
August 18, 1920 *Deputy State Commissioner of Health*

SYRACUSE

Plans were approved on September 2, 1920, for the extension from Spencer street to Hiawatha street of the existing main intercepting sewer of the city of Syracuse. The report upon the examination of the plans, together with the permit issued in connection with the approval of the plans, follow:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on our examination of plans for the extension from Spencer street to Hiawatha street of the existing main inter-

cepting sewer of the city of Syracuse, Onondaga county, submitted to this Department for approval by the Syracuse Intercepting Sewer Board on August 27, 1920.

General

Syracuse is located in the central part of Onondaga county at the southeasterly end of Onondaga lake. All but a relatively small area of about 600 acres in the southeastern section of the city drains into Onondaga lake through Onondaga creek, Harbor brook, and Ley creek. Most of the city, however, drains into Onondaga creek which flows in a northerly direction through the central part of the city. The old Erie canal extends through the city from west to east, and one of the terminals or harbors of the State Barge canal is situated on Onondaga creek in the north central part of the city.

The city of Syracuse has an area of about 11.500 acres and a population of about 172,000, giving an average density of population from the entire area of approximately 15 persons per acre. The actual density of population, however, varies from 2 to 70 persons per acre. The population tributary to the public sewer system and intercepting sewers is estimated at 158,000. The remainder of the population is not reached by the existing sewers and is provided with privies and cesspools.

The water supply of the city is derived from Skaneateles lake and is delivered to the city by gravity. The water is sterilized with liquid chlorine at certain seasons of the year. The present water consumption is approximately 26,000,000 gallons per day, and it is estimated that about 160,000 persons are supplied with the public water supply.

According to data submitted by the Intercepting Sewer Board, the present average dry weather flow of sewage tributary to the intercepting sewers is 22.62 million gallons per day, equal to a per capita rate of sewage contribution of 143 gallons per day. The present average flow of sewage, which includes storm water, is estimated at 30.37 million gallons per day, equal to a daily per capita rate of sewage contribution of 191 gallons. The population that will be tributary to the intercepting sewers of the city in 1940 is estimated at 220,000 gallons, and the average dry weather flow of sewage in 1940 is estimated at 27.52 million gallons per day, equal to a per capita rate of sewage flow of 125 gallons per day. The average rate of sewage flow in 1940 is estimated at 35.27 million gallons per day, equal to a rate of sewage flow of 160 gallons per capita per day.

With the exception of a small section in the northeastern part of the city having an area of about 600 acres, practically the entire city is sewered on the combined plan. Most of the sewers of the city have been constructed in general accordance with plans prepared by Samuel M. Gray of Providence, in 1895. The socalled Gray plans were adopted as the official map of the city of Syracuse under chapter 542 of the Laws of 1907. Certain modifications have been made in these plans by the Intercepting Sewer Board established by chapter 356 of the Laws of 1907. In this connection it may be noted that except for plans for sanitary sewers in the socalled Huntley tract, and for certain sanitary sewers in the 17th ward of the city, approved by this Department in 1915, plans for none of the sewers constructed in the city have been submitted to and received the approval of this Department before their construction.

The socalled Gray plans provided for the construction of combined sewers in all but the socalled Huntley tract in the northeastern section of the city tributary to Ley creek, and for the ultimate interception and concentration of the sewage tributary to these sewers at Hiawatha street. That objectionable conditions would be created by the discharge of sewage from these sewers into Onondaga creek and Harbor brook, and ultimately into Onondaga lake, and the need for the interception and the treatment of the sewage of the city, were recognized by Mr. Gray. In fact, he pointed out that even in 1894 the dilution afforded by Onondaga creek and Harbor brook was inadequate to prevent the creation of a nuisance in these streams, and accordingly designed plans for the interception of the sewage tributary to these streams and for the discharge of the sewage intercepted into Onondaga creek to Hiawatha street, near the lake.

The lateral sewers of the city which have been constructed in general accordance with the Gray plans, were designed to care for all of the sanitary or domestic sewage of the city tributary to Onondaga lake, and for rainfalls of from ½ to ¾ inches per hour. They were planned to discharge into Onondaga creek and Harbor brook at the foot of nearly every street leading to these streams. The plans prepared by Mr. Gray for intercepting sewers along Onondaga creek and Harbor brook have been modified somewhat by the Intercepting Sewer Board. These sewers as finally constructed were planned to care for a maximum flow of sewage from an ultimate future population of about 400,000, which it is expected will be reached in about 70 years, and in addition an amount of storm water equivalent to this flow of sewage being estimated at 187.5 gallons per day. In estimating the dry weather flow it was assumed that the ultimate average flow of domestic sewage will be 125 gallons per day, and that the maximum rate of flow will be 50 per cent greater than the average flow. The intercepting sewers have therefore a combined capacity of approximately 150,000,000 gallons per day, equal to about six times the present dry weather flow of sewage.

The sewage collected by the sewers of the city formerly discharged into Onondaga creek and Harbor brook through numerous outlets. In order to relieve the insanitary conditions created by the discharge of sewage into these streams, the Syracuse Intercepting Sewer Board improved and in certain sections lowered the channel of Onondaga creek and constructed the present intercepting system of sewers. These sewers now discharge into Onondaga creek near Spencer street and near Hiawatha street. These intercepting sewers provide for the interception of all of the dry weather flow from the lateral sewers and for the storm water up to the capacity of the intercepting sewers. The excess flow of sewage is discharged through regulated overflows at the points where the lateral sewers are intercepted by the intercepting sewers.

Thus it will be seen that the intercepting sewers are expected to care for an amount of storm water equal to about five times the present dry weather flow, but that ultimately, when the population reaches 400,000, they will care for only twice the maximum dry weather flow of sewage. Although it is not stated how frequently the lateral sewers will overflow into Onondaga creek and Harbor brook as a result of the limited capacity of the intercepting sewers, it is obvious, with a combined capacity of the two intercepting sewers of only 150,000,000 gallons per day, which is equivalent to about .025 inch of rainfall per hour over the area served by these sewers, that overflowing of combined sewage will occur frequently at the present time, and increasingly more so in the future as the ultimate population is reached.

The main intercepting sewer varies in size from 24- to 90-inches in diameter, and at present discharges into Onondaga creek near Spencer street above the Barge canal harbor. The socalled Harbor brook intercepting sewer varies in size from 18 to 54-inches in diameter, and discharges into Onondaga creek at Hiawatha street below the Barge canal harbor. The discharge of sewage and the deposits of sludge into Barge canal harbor has created a serious nuisance. In order to remedy this condition, the city is now planning to extend the intercepting sewer to the point below the harbor and finally to treat this sewage collected by the intercepting sewers in a sewage disposal plant to be located north of Hiawatha street, and to discharge the effluent into Onondaga lake through multiple outlets about 1,300 feet from the shore.

Plans now submitted provide for the extension of the existing main intercepting sewer from its point of discharge into Onondaga creek at Spencer street to the proposed disposal plant at Hiawatha street, about 5,000 feet from Spencer street, and for the interception of the existing Harbor brook existing sewer at Hiawatha street. General tentative plans for the disposal of the sewage have also been submitted, but these plans have not been worked out in detail, and since it is the desire that earliest possible action be taken by the Department upon the intercepting sewer extension from Spencer street to the disposal plant in order that the construction thereof may be undertaken at once, the question of approval of the sewage disposal plans will not be considered at this time.

The problem of the interception and disposal of the sewage of the city has been subject to detailed studies and experiment by Mr. Glenn B. Holmes, chief engineer for the Intercepting Sewer Board for the past 12 years, and early this year Metcalf & Eddy, consulting engineers of Boston, were engaged to pass upon the plans and report prepared by Mr. Holmes. After a detailed study of the entire problem by these engineers covering a period of some 4 months, a report setting forth the findings and results of these studies was transmitted to the city. This report, a copy of which has been transmitted to this Department, endorses in general the conclusions and recommendations and report of Mr. Holmes.

As noted above, the detailed plans now under consideration provide for the extension of the existing main intercepting sewer from the temporary outlet chamber near Spencer street to the proposed disposal plant site north of Hiawatha street, a distance of 4,863 feet, and for the interception of the Harbor brook interceptor at Hiawatha street. The proposed extension to the main interceptor is to be 90-inches in diameter, and is to be laid on a slope of 0.06 per cent from the present temporary outlet to Hiawatha street. This section of the sewer will have a capacity when flowing full of approximately 130,000,000 gallons. Below Hiawatha street, the point of interception of the Harbor brook interceptor, the main intercepting sewer will be laid on a slope of 0.09 per cent and will have a capacity of about 155,000,000 gallons per day, which is a little greater than the combined capacities of the two interceptors above Hiawatha street.

The main intercepting sewer is to be constructed either of reinforced concrete or of segmental blocks. Manholes are to be placed at each point of change of alignment and at intermediate points not more than 500 feet apart. The changes of alignment of the sewer, however, will be made on a radius of 80 feet. The sewer is to be supported on piles placed 3 feet center to center longitudinally and about 3 feet 6 inches center to center transversely. The pipe is to be laid in private right of way and through State land for the greater part of its length. Where the sewer runs through low areas the pipe is to be back filled to a depth of not less than 2½ feet according to scale dimensions.

It is proposed to cross Onondaga creek near the upper end of the proposed extension by means of a double tube inverted siphon 103 feet long between the lower and upper entrance chambers. The siphon is to consist of two 48-inch pipes incased in concrete. These pipes are to be of ¼-inch lock-bar steel pipe, or class A iron pipe, or lock-joint type of reinforced concrete. A difference of elevation of 1.02 feet is provided between the invert elevation of the intercepting sewer above and below the siphon, thereby giving a hydraulic gradient of about 1 per cent so that one of the 48-inch pipes will have a carrying capacity of some 140 cubic feet per second. Under ordinary conditions of dry weather flow, only one of the two pipes will be in use. An overflow or relief weir with its crest about 4 feet above the invert of the main intercepting sewer is to be installed in the headhouse or upper entrance chamber between the two tubes of the siphon, and a similar weir is to be placed between the 2 pipes in the lower entrance chamber, so that ordinarily all of the sewage of the main interceptor will flow through one pipe until the sewage rises about 4 feet above the invert of the interceptor when the excess sewage will flow over the weir into the second tube of the siphon. Stop planks are also to be provided at the upper and lower ends of these tubes so that either of the 2 tubes may be closed off if desirable.

It would seem therefore that this extension to the main intercepting sewer of the city from Spencer street to the proposed disposal plant, so far as its capacity is concerned, will take the flow of the intercepting sewer above Spencer street and the contribution from the Harbor brook interceptor at Hiawatha street, and within this limitation of capacity might appropriately be approved. It should be clearly borne in mind, however, that in approving this sewer extension that this Department would not assume any responsibility for the propriety of the design of the intercepting sewers above these points, either as to sizes, capacities, or grades, or as to any allowance or provision for storm water from sewers discharging into them. Although a limited allowance for inclusion of storm water has been provided in these intercepting sewers, storm overflows, as previously pointed out, are an inherent part of these systems; and if in the future any objectionable conditions arise in Onondaga creek, the Barge canal harbor, or in the lake itself, from these overflows, the responsibility for correcting them obviously rests entirely with the city.

With this clear understanding of the responsibility which the city must assume with reference to the intercepting sewers already constructed in the city, but in view of the urgent need for improving conditions with respect to sewage now discharged and creating a nuisance in Onondaga creek and the Barge canal harbor, and the appropriate capacity of the sewer extension from Spencer street to the proposed disposal works which will convey the sewage of the Onondaga and Harbor brook interceptors to the sewage disposal works, general plans for which have been submitted and will be subsequently reported upon, I beg to recommend that the plans for the intercepting sewer extension from Spencer street to the proposed disposal works now submitted be approved, and a permit be granted for the discharge of sewage therethrough into Onondaga lake, upon the following conditions:

1. That the proposed intercepting sewer extension shall be constructed in complete conformity with the plans or approved amendments thereof.
2. That before this intercepting sewer extension is put in operation, or any sewage discharged therethrough, sewage disposal works and outfall sewers shall be constructed to treat the sewage of the city, plans for which shall first be submitted to and receive the approval of the State Department of Health.
3. That on or before January 1, 1921, satisfactory detailed plans for sewage disposal works and outfall sewers shall be submitted to this Department for approval, and after the approval thereof said works and outfall sewers shall be constructed and put in operation at such time as the State Commissioner of Health may designate.
4. That no sewage overflow shall be constructed by the city of Syracuse to discharge into Onondaga creek, the Barge canal harbor, or the Barge canal between Plum street and Onondaga lake.
5. That whenever in the opinion of the State Commissioner of Health objectionable conditions occur resulting from the overflow of combined sewage, relief sewers shall be constructed to remedy the same, plans for which shall first be submitted to and receive the approval of the State Commissioner of Health.

Respectfully submitted
THEODORE HORTON
ALBANY, N. Y., *September* 1, 1920 *Chief Engineer*

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 77 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Syracuse Intercepting Sewer Board to discharge sewage from the proposed main intercepting sewer extension into the waters of Onondaga lake, after such sewage shall first have been passed through and treated in sewage disposal works to be constructed by the city, within the city of Syracuse, Onondaga county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That the proposed intercepting sewer extension shown by the plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.

2. That before this intercepting sewer extension is put in operation, or any sewage discharged therethrough, sewage disposal works and outfall sewers shall be constructed to treat the sewage of the city, plans for which shall first be submitted to and receive the approval of the State Department of Health.

3. That on or before January 1, 1921, satisfactory detailed plans for sewage disposal works and outfall sewers shall be submitted to this Department for approval, and after the approval thereof said works and outfall sewers shall be constructed and put in operation at such time as the State Commissioner of Health may designate.

4. That no sewage overflows shall be constructed by the city of Syracuse to discharge into Onondaga creek, the Barge canal harbor, or the Barge canal between Plum street and Onondaga lake.

5. That whenever in the opinion of the State Commissioner of Health objectionable conditions occur resulting from the overflow of combined sewage, relief sewers shall be constructed to remedy the same, plans for which shall first be submitted to and receive the approval of the State Commissioner of Health.

M. NICOLL, JR.
September 2, 1920 *Acting State Commissioner of Health*

TONAWANDA (Town) (Dunlop America, Limited)

Plans were approved on September 27, 1920, for the disposal of sanitary sewage and trade wastes from the factory of the Dunlop America, Limited, in the town of Tonawanda, Erie county. The sewage from a population of 4,000 persons, estimated at about 100,000 gallons daily, is to be treated in a sewage disposal plant consisting of settling tanks and contact beds. The trade wastes, which contain no acids, caustics, or alkalies, have only certain impurities such as dirt, leaves, splinters, and other matter which are to be removed by settling basins. The permits issued in connection with the approval of the plans follow.

PERMITS

Application having been duly made to the State Commissioner of Health, as provided by section 78 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Dunlop America, Limited, to discharge partially treated trade wastes from the plant of said organization in the town of Tonawanda, into the waters of the Erie canal opposite their property, within the town of Tonawanda, Erie county, N. Y., in accordance with the plans accompanying the petition, under the following conditions::

1. That when necessary, sludge and settled deposits shall be removed from the proposed settlement tanks for trade wastes in such a manner as to cause no nuisance, and disposed of by burying in some remote place or in some other satisfactory manner without the creation of a nuisance.

2. That whenever required by the State Commissioner of Health the sewer carrying trade wastes shall be extended to the Niagara river under plans which must first be submitted to and receive the approval of this Department.

3. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment of the industrial wastes shall be submitted for approval; and upon approval of said plans any or all portions of such additional or supplementary works for more complete treatment of the industrial

wastes shall be constructed and put in operation at such time or times thereafter as said Commmissioner may designate.

M. NICOLL, JR.
September 27, 1920 *Acting State Commissioner of Health*

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Laws" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Dunlop America, Limited, to discharge sewage effluent from the proposed sewage disposal plant of said organization in the town of Tonawanda, into the waters of the Erie canal opposite their property, within the town of Tonawanda, Erie county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That both the sewer system and sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
2. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sanitary sewers.
3. That when necessary sludge shall be removed from the proposed tanks in such a manner as to cause no nuisance, and disposed of by burying in some remote place or in some other satisfactory manner without the creation of a nuisance.
4. That no scum or sludge from any part of the disposal works shall be discharged into the Erie canal, Niagara river, or into any watercourse or body of surface water, or deposited where it may be carried thereinto by rain or melting snow.
5. That whenever required by the State Commissioner of Health, the sewer carrying sewage effluent shall be extended to the Niagara river under plans which must first be submitted to and receive the approval of this Department.
6. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment of the sewage shall be submitted for approval; and upon approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.
September 27, 1920 *Acting State Commissioner of Health*

TONAWANDA (Town) (DuPont Fibersilk Company)

Plans were approved on September 2, 1920, for the disposal of sewage and trade wastes from the factory of the DuPont Fibersilk Company, in the town of Tonawanda, Erie county. The plans provided for the discharge of trade wastes (about 750,000 gallons daily) through a 54-inch sewer into the Erie canal and for the treatment of the sanitary sewage from a population of 700 persons by sedimentation only before its discharge into the Niagara river. The permits issued in connection with the approval of the plans follow:

PERMITS

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law," as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws permission is hereby given to the DuPont

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Fibersilk Company, Inc., to discharge sewage effluent from the settling tank to serve the factory of said company in the town of Tonawanda, into the waters of Niagara river opposite their property, within the town of Tonawanda, Erie county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That on the sanitary sewer system a manhole be placed near the shore end of the flexible joint submerged outfall pipe.
2. That the proposed settling tank be so arranged that the sewage will enter it by means of a trough behind a baffle similar to the arrangement shown for the exit of the effluent.
3. That with the exception of the above conditions Nos. 1 and 2, the proposed works shown by the plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers for the collection of domestic sewage or to the proposed plant for the treatment of domestic sewage.
5. That when necessary the sludge shall be removed from the proposed tank in such a manner as to cause no nuisance, and disposed of by burying in some remote place, or on suitable sludge drying beds plans for which must first be submitted to and receive the approval of this Department before they are constructed.
6. That no sewage sludge from any part of the disposal works shall be discharged into the Erie canal or Niagara river or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.
7. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment or disposal of the sewage of the DuPont Fibersilk Company, Inc., shall be submitted for approval; and upon the approval of said plans any or all portions of such additional or supplementary works for more complete treatment or disposal of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.

September 2, 1920 — *Acting State Commissioner of Health*

Application having been duly made to the State Commissioner of Health, as provided by section 78 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the DuPont Fibersilk Company, Inc., to discharge trade wastes from the factory of said company in the town of Tonawanda, into the waters of the Erie canal, opposite their property, within the town of Tonawanda, Erie county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That the sewers conducting trade wastes into the trunk sewer be so arranged that should it be found that the wastes discharged by these sewers produce objectionable conditions, treatment plants shall be installed to treat the wastes, plans for which treatment plants must first be submitted to and receive the approval of the State Department of Health.
2. That whenever required by the State Commissioner of Health, the sewer carrying trade wastes shall be extended to the Niagara river under plans which must first be submitted to and receive the approval of the Department.

M. NICOLL, JR.

September 2, 1920 — *Acting State Commissioner of Health*

Revised plans were approved on October 15, 1920, for the proposed sewerage system and disposal plant for the sanitary sewage from the factory of the DuPont Fibersilk Company, in the town of Tonawanda. The plans provided for a screen chamber, construction of siphons in duplicate, and extension of outfall pipe into the Niagara river, 150 feet from shore. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the DuPont Fibersilk Company to discharge effluent from the proposed disposal plant to care for the domestic sewage from the factory of said company in the town of Tonawanda into the waters of the Niagara river opposite their property within the town of Tonawanda, Erie county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That the platform for draining the screens be constructed of and supported by concrete and contain no apertures larger than ½-inch in diameter.
2. That the bar screen shall extend from side to side entirely across the screen chamber so that a screen with openings not wider than 2 inches shall be continuously maintained in front of both pipes on the siphon.
3. That with the exception of the recommendations 1 and 2 above, the sewerage system and sewage disposal works and outfall pipe shown by the plans shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewage disposal works.
5. That no sewage sludge from any part of the disposal works shall be discharged into the Niagara river or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.
6. That when necessary the sludge shall be removed from the proposed tank in such a manner as to cause no nuisance, and disposed of by burying in some remote place.
7. That whenever required by the State Commissioner of Health, satisfactory detailed plans for additional works for more complete treatment of the sewage from the factory shall be submitted for approval; and upon the approval of said plans any or all portions of such additional or supplementary works for more complete treatment of sewage shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.
October 15, 1920 *Deputy State Commissioner of Health*

TONAWANDA (Town) (Philadelphia Rubber Works Co.)

Plans were approved on June 25, 1920, for the disposal of sewage and trade wastes from the factory of the Philadelphia Rubber Works Company, in the town of Tonawanda, Erie county. The domestic sewage, according to the plans, will be collected by a system of sewers ranging from 6 to 10 inches in diameter, and treated in a disposal plant consisting of a settling tank and contact beds. The trade wastes from the factory will consist of about 1,000,000 gallons of wash water per day, which will be passed through a settling tank and screens and discharged, together with about 2,500,000 gallons of water used for cooling purposes, into the storm water sewer system. This sewer system will consist of mains varying from 8 to 54 inches in diameter, which will discharge the wastes and waste water into the Erie canal. The permits issued in connection with the approval of the plans follow:

PERMITS

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Philadelphia Rubber Works Company to discharge effluent from the proposed sewage disposal works to treat the domestic sewage from the factory of the company at Tonawanda, Erie county, N. Y., into the waters of the Niagara river at the point shown on the plans on the property of the company, within the town of Tonawanda, Erie county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof except that the contact beds shown need not be constructed until required by the State Commissioner of Health.
2. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers for the collection of domestic sewage or the sewage disposal plant for the treatment of domestic sewage.
3. That when necessary the sludge shall be removed from the proposed tank in such a manner as to cause no nuisance, and disposed of by burying in some remote place.
4. That no sewage sludge from any part of the disposal works shall be discharged into the Niagara river or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.
5. That whenever required by the State Commissioner of Health, the contact beds shown on the plans shall be constructed in complete conformity with the plans and put in operation at such time or times thereafter as said Commissioner may designate.
6. That in order to assure continuous operation the ejectors for lifting the domestic sewage over the bridge across the Erie canal be installed in duplicate

M. NICOLL, JR.
June 25, 1920 *Deputy State Commissioner of Health*

Application having been duly made to the State Commissioner of Health, as provided by sections 78 and 79 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Philadelphia Rubber Works Company to discharge trade wastes from their factory at Tonawanda, Erie county, N. Y., after settlement and screening, into the waters of the Erie canal at the point shown on the plans on the property of the company, within the town of Tonawanda, Erie county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That the sewerage system and the settling tank and screening plant for the collection and treatment of trade wastes shall be fully constructed in complete conformity with plans approved this day or approved amendments thereof.
2. That whenever required by the State Commissioner of Health, detailed plans for additional works for the more complete treatment of

the trade wastes from the factory of the Philadelphia Rubber Works Company at Tonawanda, Erie county, N. Y., shall be submitted for approval; and upon the approval of said plans any or all portions of such additional or supplementary works for more complete treatment of trade wastes shall be constructed and put in operation at such time or times thereafter as said Commissioner may designate.

M. NICOLL, JR.
June 25, 1920 *Deputy State Commissioner of Health*

TUCKAHOE

Plans were approved on June 22, 1920, for sewer extensions in Hollywood avenue, Bella Vista avenue, Hall street, and Dante avenue, in the village of Tuckahoe. The permit issued in connection with the approval of the plans contained in addition to the usual complete construction and storm water clauses, the following condition:

That when the extensions beyond the upper manholes shown on the plans on Hollywood and Bella Vista avenues are planned for construction, the plans for these extensions be first submitted to this Department for approval.

UNION

Plans were approved on July 14, 1920, for a sewerage system and temporary sewage disposal plant for a portion of the village and the town of Union. The report upon the examination of the plans and the permit issued in connection with their approval follow:

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on the examination of the plans for a sewerage system and temporary sewage disposal plant to serve a certain area owned by the Endicott–Johnson Corporation, lying partially in the northwest corner of the village of Union, Broome county, N. Y., and partially in the town of Union immediately adjacent to that corner of the village, submitted to this Department for approval by the Endicott–Johnson Corporation on June 30, 1920.

The records of this Department show that plans for a system of sewers covering a part of the area now under consideration were submitted to this Department for approval by the board of trustees of the village of Union in 1919, and approved on December 9 of that year, with the condition that before the sewers were put in use satisfactory plans for an intercepting sewer and sewage disposal works should be submitted to this Department for approval, and after approval put in operation whenever required by the State Commissioner of Health. The sewage from the district was, according to the plans, to be discharged into the Susquehanna river within the village and town of Union.

It now appears that the Endicott–Johnson Corporation has built and are building a number of houses in the district under consideration and desires to provide sewerage for these houses. The village authorities, however, do not deem it advisable to make any extensions to their sewerage system at the present time; and for that reason the Endicott–Johnson Corporation, which according to the statement in its application owns all the property in the district, including the streets, has prepared plans for the sewerage system to serve it and for the sewage disposal plant for temporarily disposing of the sewage collected. It is estimated by the designing engineer that the population of the district will ultimately reach about 1,000 persons, or the equivalent of about 12 persons per acre, or 6 persons per 100 feet of sewer. The plans include some of the streets shown on the plan approved by this Department on December 9, 1919, and modify some of the sewers shown on that plan reversing the direction of the flow on Jennings street and on Dwight street.

The plans as submitted contemplate the construction of about 3½ miles of vitrified tile sewer with the usual appurtenances, and the construction of a temporary disposal plant consisting of a sedimentation tank, pumping plant, and sand filter.

The sewers will be of tile pipe and consist of about 15,900 feet of 8-inch, 3,480 feet of 10-inch, and 1,700 feet of 12-inch pipe. Of this about 3,600 feet apparently do not drain to the temporary sewage disposal plant, and for that reason cannot be put in use until the new trunk sewer line and disposal plant are constructed. All sewers appear to be of sufficient size to carry the sewage that will probably reach them, and the grades will be sufficiently steep to provide self-cleansing velocities if the sewers are properly laid. The minimum grade on the 8-inch lines is 0.4 per cent, on the 10-inch lines 0.29 per cent, and on the 12-inch lines 0.21 per cent. Manholes are provided at frequent intervals, and at all intersections and changes in grade or alignment, the average distance between manholes being about 250 feet and the maximum distance about 400 feet.

The settling tank is a covered concrete structure divided into two compartments by a longitudinal wall. Each compartment is 11 feet 6 inches by 29 feet 6 inches in plan, and about 7 feet deep below the flow line. The flow line is, however, 6 inches above the crest of the outlet weir, and for that reason the net capacity of the tank is only about 32,000 gallons, the equivalent of approximately 8 hours average flow. The sewage will enter the tank at the center of the inlet ends of the compartments and leave over concrete weirs extending the full width of the outlet ends of the compartments. Transverse wooden baffles extending 12 inches below the level of the crest of the outlet weirs and set 18 inches from the inlet and outlet ends of the compartments are provided to distribute the flow evenly over the cross-section of the tank and prevent the escape of floating particles. The pipes at the inlet end of the tank are so arranged that the sewage may be turned into either or both of the tanks at the will of the operator. This will, of course, allow the sewage to be turned through one tank while the other tank is being cleaned, provided the water level in the adjacent pump chamber is kept below the crest of the outlet weir. Two manholes are provided in the roof of each compartment to afford access for inspection and cleaning.

According to the statement of the designing engineer, the sludge will be removed from time to time by pumping through the manholes, and carted to a remote place on one of the farms of the corporation and there finally disposed of by plowing in the ground.

Immediately adjacent to the outlet end of the settling tank and extending the full width of it will be a covered concrete pump chamber 25 feet 3 inches by 14 feet 10 inches in plan, and 3 feet 2 inches deep below the outlet weir of the tank or 4 feet 2 inches deep below the maximum flow line of the tank. The net capacity of the chamber will therefore be about 9,000 gallons or a little over 2 hours flow, while the total capacity including the 1 foot head available from the settling tank will be about 16,800 gallons or approximately 4 hours average flow.

The elevation of the roof of the settling tank and pump chamber is about 7 feet below extreme high water in the Nanticoke creek adjacent to the plant, and it is understood from the engineer's report that for that reason the tank and pump chamber will be made watertight.

A pumping plant will be installed just west of the settling tank and pump chamber, and between them and the sand beds, to lift the sewage from the tanks, the elevation of the flow line of which is to be 816.8, to the sand beds the elevation of the surface of which will be 818.0. The pumping plant will be housed in a building about 15 feet square with its floor raised above extreme high water level to protect the machinery from high water. The equipment will consist of one 4-inch single stage centrifugal pump rated at 600 gallons per minute, arranged to be driven by a 15-hp. three-phase motor or a 15-hp. gasoline engine. The motor and engine will be belt connected to the pump, and their operation will be manually controlled. Under normal conditions the pump will be operated by the motor and with current supplied from the factory of the Endicott-Johnson Corporation. The gasoline engine will be held in reserve for use in case of failure of the electric power.

Five sand beds will be provided, each 100 by 80 feet in size, making the total area about 0.9 of an acre, and the rate of filtration based on a flow of 100 gallons per capita per day about 110,000 gallons per acre per day. The filter material will consist of from 3 feet to 3 feet 6 inches of sand, having an effective size of 0.25 mm. and a uniformity coefficient of not over 3, resting on a 2-inch layer of coarse sand. The sewage will be distributed over the beds by means of wooden troughs and the effluent collected by single lines of 12-inch tile pipe laid in gravel along the center of each bed. These underdrains will connect to a 12-inch main drain which will discharge into Nanticoke creek near the plant. The arrangement of the underdrains is therefore such that the distance from the sides of the beds to the drain will be about 40 feet, a distance which seems too great to assure satisfactory draining of the beds, particularly as no layer of coarse gravel or broken stone is according to the plans to be provided under the sand. It would seem desirable therefore that the spacing of the underdrains should be reduced, and that a layer of gravel or broken stone should be provided on the bottom of the beds to facilitate the passage of the effluent to the underdrains. The maximum dose from the pump station will be, as stated above, 16,800 gallons, or the equivalent to a depth of about 3½ inches on one sand bed. Manually operated valves will be provided for turning the flow on to any bed at the option of the operator.

As noted on June 30 by an engineer in this Department, in an interview with the engineer of the proposed plant, the distribution and drainage system of the filter should be made uniform. At present the section of filter surface in which the words "Distributing Trough" appear, has an area of 200 square feet supplied from a trough-lip length of 100 feet, while the section in which occurs the word "Underdrain" has an area of 100 square feet and a lip of 120 feet, apparently giving one area between two and three times the intensity of application of the other. Hence the regulation of lip elevations or perforations must be carefully worked out and the surface grading properly maintained to guard against uneven distribution.

The elevation of the surface of the beds will be 818.0 or 7 feet below extreme high water in the creek, and in order to protect the beds in time of such high water an embankment will be constructed around them and carried up above the highest elevation that the water will probably reach. A check valve will be provided on the outlet from the beds to prevent the river water from backing up into them. This arrangement will not of course prevent the beds from becoming flooded during periods of high water, for while it may not be possible for the river water to enter the beds the sewage will not be able to escape into the river and will therefore rise on the beds. The condition thus created will undoubtedly deleteriously affect the efficient operation of the beds, but since at such times the dilution will be large it is probable that no unsatisfactory condition will be created if the filters are operated with proper care.

It is understood from the engineer's report that this disposal plant is for temporary use only, and that it is intended in a few years to construct and put in operation an intercepting sewer and disposal plant for the treatment of the sewage of the village and the adjacent district, and that the sewage collected by the system at present under consideration will be ultimately connected to this intercepting sewer and disposal plant.

In view of the above facts, and after a careful consideration of the essential features of the design and of general and local conditions, I would recommend that the plans be approved and a permit issued to the Endicott-Johnson Corporation allowing the discharge of the effluent from the proposed temporary sewage disposal plant into the waters of Nanticoke creek at the point shown by the plans on the property owned by the corporation in the town of Union, Broome county, N. Y., with the following conditions:

1. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof, except where variations are expressly required by the conditions of this permit.
2. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers and sewage disposal works.

3. That when necessary the sludge shall be removed from the proposed tank in such a manner as to cause no nuisance, and disposed of by burying or ploughing into the ground in some remote place.

4. That no sewage sludge from any part of the disposal works shall be discharged into Nanticoke creek or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.

5. That the spacing of the underdrains of the sand bed be reduced to not greater than 15 feet center to center, and that the bottom of the bed be properly graded and covered with gravel or broken stone of suitable size in order to facilitate the draining of the beds.

6. That, before that portion of the proposed sewerage system shown on the plans approved this day and not draining to the temporary sewage disposal plant, is put in use, satisfactory plans for an intercepting sewer and sewage disposal works for the treatment of the sewage from that portion of the sewerage system shall be submitted to this Department for approval; and that after the approval of said plans any or all parts of such intercepting sewer and sewage disposal plant shall be constructed and put in operation.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *July* 13, 1920

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 78 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Endicott–Johnson Corporation to discharge effluent from the proposed temporary sewage disposal plant to serve the property of said corporation in the town and village of Union, near Nanticoke creek, into the waters of Nanticoke creek at the point shown by the plans on the property owned by the corporation, within the town of Union, Broome county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That both the sewer system and the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof, except where variations are expressly required by the conditions of this permit.

2. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers and sewage disposal works.

3. That when necessary the sludge shall be removed from the proposed tank in such a manner as to cause no nuisance, and disposed of by burying or ploughing into the ground in some remote place.

4. That no sewage sludge from any part of the disposal works shall be discharged into Nanticoke creek or any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.

5. That the spacing of the underdrains of the sand bed be reduced to not greater than 15 feet center to center and that the bottom of the bed be properly graded and covered with gravel or broken stone of suitable size in order to facilitate the draining of the bed.

6. That before that portion of the proposed sewerage system shown on the plans approved this day and not draining to the temporary sewage disposal plant is put in use, satisfactory plans for an intercepting sewer and sewage disposal works for the treatment of the sewage from that portion of the sewerage system shall be submitted to this Department for approval; and that after the approval of said plans any or all parts of such intercepting sewer and sewage disposal plant shall be constructed and put in operation.

M. NICOLL, JR.
Deputy State Commissioner of Health

July 14, 1920

WATERFORD (State Commission of Highways)

Plans were approved on July 14, 1920, for the disposal of sewage from the storehouse of the State Commission of Highways in the village of Waterford. The plans provided for the treatment of the sewage in a septic tank and its discharge into the Barge canal. No permit was issued in connection with the approval of the plans.

WATERTOWN

Plans were approved on January 7, 1920, for a proposed sewer in Dewey street, in the city of Watertown. On June 15, 1920, plans were approved for proposed sewers in Palmer street, in the city of Watertown. The permits issued in connection with the approval of these plans contained only the usual revocation, modification, complete construction, and storm water clauses.

WOLCOTT (Town) (Leavenworth Institute and Wolcott High School)

Plans were approved on February 21, 1920, for a sewage disposal plant to serve the Leavenworth Institute and Wolcott High School, in School District No. 1 of the town of Wolcott, Wayne county. The plans provided for a sewage disposal plant consisting of a settling tank, dosing chamber, and subsurface irrigation system. The permit issued in connection with the approval of the plans follows:

PERMIT

Application having been duly made to the State Commissioner of Health, as provided by section 76 of chapter 49 of the Laws of 1909, the "Public Health Law" as amended by chapter 553 of the Laws of 1911, constituting chapter 45 of the Consolidated Laws, permission is hereby given to the Board of Education of School District No. 1, in the town of Wolcott, to discharge the effluent from the proposed sewage disposal plant to serve Leavenworth Institute and Wolcott High School into the ground waters of the State tributary to Wolcott creek, within the municipality of Wolcott, Wayne county, N. Y., in accordance with the plans accompanying the petition, under the following conditions:

1. That this permit shall be revocable at any time or subject to modification or change when in the judgment of the State Commissioner of Health such revocation, modification, or change shall become necessary.
2. That the issuance of this permit shall not be deemed to affect in any way action by this Department on any future application that may be made for permission to discharge additional sewage or effluent into the waters of this State.
3. That the sewage disposal works shown by plans approved this day shall be fully constructed in complete conformity with such plans or approved amendments thereof.
4. That only sanitary or domestic sewage and no storm water or surface water from streets, roofs, or other areas shall be admitted to the proposed sewers.
5. That the length of tile in the subsurface irrigation field be made such that the total length will be equivalent to 5 feet for each pupil attending the school, and that should the number of pupils increase the number of feet of tile in the field shall be correspondingly increased, or other satisfactory methods of final disposal provided.
6. That the sludge be removed from the settling tank when necessary in such a manner as to cause no nuisance, and be disposed of by burying in some remote place.
7. That no sludge or sewage from any part of the proposed sewage disposal works shall be discharged or allowed to flow into Wolcott creek or into any other watercourse, or deposited on the ground where it may be washed by rain or melting snow into any watercourse.

M. NICOLL, JR.

February 21, 1920 *Deputy State Commissioner of Health*

INDIVIDUAL PERMITS ISSUED DURING 1920, AS PROVIDED BY ARTICLE V OF THE PUBLIC HEALTH LAW

LOCATION	To whom issued	1920	Waste matter	Discharged into
Bedford (Town), Westchester county.	Mr. E. O. Holter	Mar. 9	Effluent from proposed sewage disposal plant to serve cottage (see page 20).	Ground waters tributary to Croton lake.
Beekman (Town), Dutchess county.	The Hopewell Realty Company	June 11	Sewage from under-drainage of leaching cesspools for Sylvan Lake Camp (see page 21).	Ground waters tributary to Sylvan lake.
Briarcliff Manor, Westchester county.	Briarcliff Manor Realty Company	Feb. 21	Effluent from proposed addition to disposal plant serving Briarcliff Manor (see page 22).	Ground waters tributary to Pocantico river.
Brookhaven (Town), Suffolk county.	Board of Managers, Suffolk County Tuberculosis Hospital.	Dec. 8	Effluent from proposed disposal plant (see page 25).	Ground waters tributary to Patchogue creek.
Canaan (Town), Columbia county.	Board of Trustees, School District No. 1.	April 22	Effluent from sewage disposal plant to serve school (see page 30).	Ground waters tributary to Stony Kill.
Chemung (Town), Chemung county.	Keystone Dairy Company, Inc.	Sept. 28	Effluent from cesspool to treat the waste water and washings from factory.	Ground waters tributary to Chemung river.
Claverack (Town), Columbia county.	States Metals Company	Sept. 2	Effluent from proposed sewage disposal plant for factory (see page 31).	Claverack creek.
Claverack (Town), Columbia county.	States Metals Company	Sept. 2	Effluent from proposed plant for treatment of trade wastes from factory (see page 32).	Claverack creek.
Columbus (Town), Chenango county.	Phenix Cheese Company	Nov. 11	Waste water and washings, cooling and condensing water, and sewage from plant (see page 37).	Unadilla river.
Cortlandt (Town), Westchester county.	Baron de Hirsch Fund	Jan. 6	Effluent from proposed plant to serve Baron de Hirsch Agricultural School (see page 38).	Tributary of Peekskill Hollow creek.
DeRuyter, Madison county	DeRuyter Cooperative Association, Inc.	Aug. 24	Effluent from tank to treat waste water and washings from factory.	East branch of Tioughnioga creek.
Dundee, Yates county	Dairymen's League Cooperative Association, Inc.	Oct. 19	Effluent from tank to treat waste water and washings from factory.	Tributary of Big stream.
Easthampton (Town), Suffolk county.	Fisheries Products Company	May 22	Effluent from works to treat trade wastes and domestic sewage from factory (see page 42).	Gardiners bay and ground waters tributary to Gardiners bay.
Ghent (Town), Columbia county.	Board of Trustees, School District No. 3.	May 20	Effluent from proposed sewage disposal plant to serve the school (see page 49).	Ground waters tributary to Kline Kill.
Greene, Chenango county	Mr. Ed. Bixby	May 5	Sewage from property	Chenango river.
Greenport (Town), Columbia county.	Board of Trustees, School District No. 1, town of Greenport.	Oct. 19	Effluent from proposed disposal plant of school (see page 50).	Ground waters tributary to Hudson river.
Hamburg (Town), Erie county	Erie County Agricultural Society	Sept. 23	Effluent from proposed sewage disposal plant at fair grounds (see page 51).	Tributary of Rush creek.
Hastings (Town), Oswego county.	Porter Products Corporation	July 9	Effluent from tanks for treatment of sewage at factory.	Oneida river.
Hempstead (Town)	Board of Education School District No. 22, town of Hempstead.	Nov. 27	Effluent from leaching cesspools to serve school (see page 52).	Ground waters tributary to Atlantic ocean.

Hume (Town), Allegany county.	Richardson Beebe Company......	Oct. 19	Effluent from settling tank to treat waste water and washings from condensery.	Genesee river.
Jefferson (Town), Schoharie county.	Jefferson Dairymen's League Co-operative Association, Inc.	July 19	Effluent from tanks to treat waste water and washings from creamery.	Middle brook.
Lenox (Town), Madison county.	I. J. Chapman & Son............	Aug. 3	Wastes and wash water from creamery......	Ground waters of this State.
Liberty (Town), Sullivan county	Loomis Sanatorium..............	Mar. 12	Effluent from proposed plant to serve sanatorium (see page 55).	Tributary of Mangaup river.
Liberty (Town), Sullivan county	Loomis Sanatorium..............	April 8	Effluent from plant to serve sanatorium (see page 58).	Tributary of Mangaup river.
Lisbon (Town), St. Lawrence county.	W. J. Murphy..................	April 29	Effluent from proposed sand filters to treat waste water and washings from factory near Flackville.	Ground waters of this State.
Middleburg, Schoharie county..	Board of Education School District No. 1, town of Middleburg.	July 9	Effluent from plant at High School (see page 68).	Ground waters tributary to branch of Schoharie creek.
Naples, Ontario county........	Steuben Products Company.......	June 11	Effluent from ensilage pit and sand filter (see page 69).	Ground waters and a tributary of Naples creek.
Newfield (Town), Tompkins county.	Board of Education School District No. 2, town of Newfield.	Jan. 31	Effluent from proposed disposal plant to serve school (see page 70).	Ground waters tributary to West Branch of Cayuga Inlet.
Newstead (Town), Erie county.	Akron Manufacturing Company..	Sept. 27	Effluent from tank to treat sanitary sewage from factory.	Swamp north of village of Akron
Newstead (Town), Erie county.	Wheat's Ice Cream Company....	Sept. 27	Effluent from tank to treat sanitary sewage from factory.	Swamp north of village of Akron.
New Windsor, Orange county..	Board of Trustees, School District No. 1, town of New Windsor.	Aug. 3	Effluent from proposed system of leaching cesspools. (see page 71).	Ground waters tributary to Hudson river.
Nunda, Livingston county....	Peck & Pratt Condensed Milk Company.	Jan. 7	Effluent from plant to treat trade wastes of condensery (see page 72).	Keshequa creek.
Nunda, Livingston county.....	Peck and Pratt Condensed Milk Company.	Jan. 7	Effluent from plant to treat domestic sewage from condensery (see page 73).	Ground waters tributary to Keshequa creek.
Orwell (Town), Oswego county.	Dr. P. D. Bailey...............	April 20	Effluent from sewage disposal plant for sanatorium (see page 74).	Orwell creek.
Oyster Bay (Town), Nassau county.	Board of Trustees, School District No. 12, town of Oyster Bay.	Aug. 30	Effluent from system of leaching cesspools (see page 75).	Ground waters tributary to Atlantic ocean.
Paris (Town), Oneida county..	Clayville Knitting Company.....	Sept. 14	Effluent from disposal plant to treat sewage from property (see page 79).	Saquoit creek.
Savannah, Wayne county......	Shefford Cheese Company, Inc....	Sept. 17	Effluent from settling tank to treat waste water and washings from factory.	Tributary of Crusoe creek.
Shandaken (Town), (Chichester) Ulster county.	Department of Water Supply, Gas and Electricity of city of New York.	Sept. 22	Effluent from proposed sewage disposal plant to treat sewage from village (see page 92).	Ground waters tributary to Stony Clove branch of Esopus creek.
Sidney (Town), Delaware county.	Beakes Dairy Company..........	May 28	Effluent from settling tank to treat waste water and washings from creamery.	Tributary of Carrs creek.
Stark (Town), Herkimer county.	John R. Snyder.................	Aug. 11	Effluent from settling tank to treat waste water and washings from Van Hornesville cooperative cheese factory.	Tributary of Otsquago creek.
Stony Point (Town), Rockland county.	Board of Education, School District No. 5, town of Stony Point.	Aug. 13	Effluent from sewage disposal plant to serve Tompkins Cove High School (see page 93).	Ground waters tributary to Hudson river.
Tonawanda (Town), Erie county	Dunlop America, Limited.........	Aug. 13	Partially treated trade wastes from factory (see page 98).	Erie canal.

INDIVIDUAL PERMITS ISSUED DURING 1920 — (*Concluded*)

LOCATION	To whom issued	1920	Waste matter	Discharged into
Tonawanda (Town), Erie county	Dunlop America, Limited.........	Sept. 27	Effluent from proposed sewage disposal plant to treat domestic sewage from factory (see page 98).	Erie canal.
Tonawanda (Town), Erie county	DuPont Fibersilk Company, Inc..	Sept. 2	Effluent from tank to treat sewage of factory (see page 99).	Niagara river.
Tonawanda (Town), Erie county	DuPont Fibersilk Coumpany, Inc.	Sept. 2	Trade wastes from factory (see page 100)....	Niagara river.
Tonawanda (Town), Erie county	DuPont Fibersilk Company, Inc..	Oct. 15	Effluent from disposal plant to treat domestic sewage from factory (see page 101).	Niagara river.
Tonawanda (Town), Erie county	Philadelphia Rubber Works Company.	June 25	Effluent from plant to treat domestic sewage from factory (see page 102).	Niagara river.
Tonawanda (Town), Erie county	Philadelphia Rubber Works Company.	June 25	Trade wastes from factory after sedimentation and screening (see page 102).	Erie canal.
Union (Town), Broome county.	Endicott-Johnson Corporation....	July 14	Effluent from temporary sewage disposal plant to serve property in town and village of Union (see page 106).	Nanticoke creek.
Winfield (Town), Cedarville, Herkimer county.	Levy Dairy Company............	Dec. 31	Effluent from cesspools for wash water and sewage from milk station and factory.	Ground waters tributary to branch of Unadilla river.
Wolcott, Wayne county........	Board of Education, School District No. 1, town of Wolcott.	Feb. 21	Effluent from proposed plant to serve Leavenworth Institute and Wolcott High School (see page 107).	Ground waters tributary to Wolcott creek.

GENERAL INVESTIGATIONS RELATING TO SEWERAGE AND SEWAGE DISPOSAL

In addition to the above work of examining and passing upon plans for sewerage and sewage disposal, investigations of the conditions of existing sewerage and sewage disposal systems have been made in the following places during 1920:

EAST SYRACUSE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the conditions of sewerage and sewage disposal of the village of East Syracuse, with special reference to the resulting pollution of Headson and Lye creeks, made on June 16 and 17, 1920, by W. C. Emigh, Assistant Engineer in this Department.

The incorporated village of East Syracuse is located in the east central part of Onondaga county, about four miles east of the city of Syracuse, on the main lines of the New York Central and West Shore railroads. The village lies between two streams: Butternut creek, which is about 1½ miles to the east of the center of the village, and Headson creek, which is about ⅛ mile to the west of the center of the village. Butternut creek flows northeast, its waters eventually reaching Oneida lake. Headson creek flows northwest into Lye creek, and thence into Onondaga lake.

In recent years the village has shown a steady increase in population. Census returns indicate in 1905, 2,996; in 1910, 3,274; in 1915, 3,839. The present population is estimated at about 4,000. One of the largest railroad yards in the State is located in this village. A metal ware factory within the corporation limits employs about 200 persons. The supply for a municipally owned water system is obtained by gravity from springs about seven miles south of the village. This water is distributed without filtration. Practically all of the population is connected to the water system. The average per capita consumption is about 80 gallons.

The sewer system consists of approximately 7½ miles of sanitary sewers, varying in size from 6 to 18 inches. About 75 per cent of the population is connected, or approximately 3,000 persons. A considerable ground water infiltration has always taken place in these sewers which, during the greater part of the year, is probably equal to, or greater than, the sewage contributed.

Sewerage System Plans and Construction

The records of this Department show that on December 21, 1900, original plans for sewers and sewage disposal works for the village of East Syracuse were approved by the Department. (See 21st Annual Report, page 84.) These plans provided for a separate sewer system, a receiving well, pumping equipment, and a chemical precipitation sewage disposal plant. The entire pumping and disposal plant was to be located near the intersection of Second and Henry streets and near the developed section of the village. Certain portions of the system as designed included sewers at a depth as great as 17 feet below ground surface. The receiving well was to be circular. Above the well was to be installed the pumping equipment which was in duplicate, a sludge press and tanks for the chemical to be used in inducing precipitation. After application of chemicals the sewage was to be pumped into 4 precipitation tanks. The effluent from these tanks was to be discharged by gravity flow through some 5,600 feet of 15-inch sewer into Butternut creek.

The construction of this sewerage system was delayed and in 1902 the question of substituting a gravity system with outlet into Headson creek in place of pumping into Butternut creek was raised by the village authorities. A report was submitted to the village by Mr. George Rafter in 1902, stating the relative merits of the case. It does not appear, however, that plans for such a gravity system to discharge into Headson creek were prepared at that time.

On November 11, 1904, plans were approved by this Department for a thoroughly revised system of sewage disposal works (see 25th Annual Report, page 382). At that time the sewerage system provided for by the original plans, with the exception of the disposal plant, was under construction and nearly completed. A receiving well was in course of construction but in accordance with the new plans. These plans included radical modifications over those of 1900. Under the plans of 1904 a receiving well was to be located at the same point as shown on plans of 1900, but it was to consist of two chambers so arranged that either or both might be used in connection with either or both of the pumps which were to be in duplicate. This detail of design evidently possessed some advantages over the former design in facility for cleaning the well. The sewage was to be pumped from this receiving well in an easterly direction through an 8-inch castiron force main to a grit chamber. Thence it was to flow by gravity to a settling tank and into the siphon dosing chamber from which it was to pass to sand filter beds. This plant was to be located on the town line road about 8,300 feet easterly from the receiving well and about 2,000 feet east of Butternut creek. From these filter beds the effluent was to flow westerly through a 10-inch tile pipe to the point of discharge into Butternut creek. At the point of crossing Butternut creek, the force main was provided with a valve intended to permit the sewage to be discharged directly into the creek should occasion arise for bypassing the disposal plant. When this valve was opened it would be necessary to pump against only 15 feet of hydrostatic head whereas to pump into the disposal plant would involve 45 feet of head. Automatic control was provided for the pumps.

The laying of the sewers was not completed until 1906. The pumping plant was installed in June, 1906. The disposal plant was accepted in the spring of 1907. The total outlay involved was about $80,000. Pumping equipment consisted of one 8-inch vertical centrifugal pump driven by one 20-horsepower induction motor in place of the duplicate equipment provided in the plans. In the process of construction a considerable quantity of ground water was encountered. The rate of infiltration into the sewers was high with a correspondingly high cost of pumping. In 1907 before the disposal plant had been placed in operation and while pumping directly into Butternut creek against a head of only 15 feet, the cost of pumping had reached $500 per month. At times it was impossible to prevent sewage from rising in some manholes due to the heavy infiltration of ground water into the sewers.

On February 19, 1908, application was made by the board of sewer commissioners for the approval of plans for an overflow from the village sewer system into Headson creek. On March 7, 1908, an engineer from this Department was sent to East Syracuse to consult with the village authorities and their engineer. As a result of this conference and from data obtained at that time and a subsequent study of the situation certain suggestions were made by this Department. On February 10, 1909, plans prepared in general accordance with the recommendations of this Department were approved (see 30th Annual Report, Vol. II, page 46). These plans provided for the elimination of the low level or deep sewers and the construction of a high level intercepting sewer in the easterly portion of the village; for the reversal of the direction of flow of sewage in certain sections; and for the conveyance of the entire sewage of the village to a sewage disposal plant consisting of septic tanks and contact beds to be located along Headson creek, some 400 feet northeast of the intersection of James and Manlius streets. These plans further showed a temporary septic tank to be located on the permanent line of the trunk sewer at a point in close proximity to the right of way of the freight line of the New York Central and Hudson River railroad, and about 600 feet down stream from the point of confluence of Marcey and Headson creeks. At the time of the approval of these plans permission was also granted for the construction of a temporary septic tank at this location having effective dimensions of 60 feet x 26 feet x 6 feet. This permit terminated on March 1, 1914, at which time a complete permanent sewage disposal plant was to have been completed and placed in operation.

On October 3, 1910, amended plans for sewerage and sewage disposal of the village were submitted to this Department. (See 31st Annual Report, page 500.) These plans showed that it was proposed to construct two permanent settling tanks at a point near the intersection of Elm and Maple streets, which point is about 800 feet southerly and upstream from the point at which it was proposed in the plans of the preceding year to construct temporary tanks for which construction permission had been granted. This proposed point of location is 200 feet above the junction of Marcey and Headson creeks. It was requested that permission be granted to temporarily discharge the effluent from the settling tanks into Marcey creek above its confluence with Headson creek. These plans further provided for the ultimate extension of the effluent pipes of the proposed settling tanks to contact and filter beds to be located north of the village about 3,000 feet distant from the settling tanks. Approval of these plans was not granted.

An inspection of the sewage disposal plant of the village made by a representative of this Department on December 8, 1914, in connection with the general investigation being carried on at that time of sewage disposal plants in the State, showed that a temporary septic tank, 13 feet x 48 feet x 6½ feet had been constructed and was in use. This tank provided an effective volume only 44 per cent as large as would have been provided in the tank specified in the temporary permit. The effluent at that time was being treated with a solution of hydrochlorite of lime before its discharge into the stream. Furthermore, this tank had been constructed at a point about 700 feet distant from the location approved for the temporary tank and near the location for which approval was refused in 1910. It was also found that the tank, due to its inadequate size and to the fact that it was practically filled with sludge and scum, gave very unsatisfactory results. It was therefore recommended that a permanent plant be constructed at once, and that until such time as such plant should be completed, the present plant be placed and maintained in an effective operating condition.

On May 29, 1915, plans were submitted to this Department showing details of certain sewers and of sewage disposal works which it was proposed to construct. These proposed new works embodied the extension of the trunk sewer from a temporary settling tank as constructed a distance of 6,200 feet following in general the line of Headson creek to the site of the proposed disposal plant. This proposed site is located about 3,300 feet down stream from the proposed location of the disposal plant as shown in the plans submitted and approved in 1909. From the disposal plant an outfall sewer is shown following the line of the stream a distance of 4,300 feet. Plans of the proposed disposal works show a preliminary settling tank of the Imhoff type, a dosing tank equipped with automatic siphons, a sprinkling filter, a final settling tank likewise of the Imhoff type and a sludge drying bed (36th Annual Report, Vol. II, page 80). After certain revisions of these plans, including the design of a coarse screen, had been made, they were approved July 23, 1915. A proposition to raise funds for the construction of the trunk sewer and disposal plant, as shown by the last plans approved was voted on by the taxpayers and defeated August 16, 1916. Since that time it appears that no move has been made for a reconsideration of this proposition.

During the year 1911 complaint was made by the owners of certain dairy farms which adjoin Headson and Lye creeks, in the towns of DeWitt and Salina, stating that municipal and industrial wastes discharged into these creeks were causing pollution of the same. This complaint was followed by a suit in which the village of East Syracuse, the Syracuse Rendering Company, the New York Central and Hudson River Railroad Company, and the Benedict Manufacturing Company were named as codefendants. A verdict was rendered in favor of the plaintiffs; the case was appealed and the verdict sustained about the first of the year 1918.

Existing Sewerage Conditions

On June 1, 1920, a communication was received from Mr. Charles A. Ray, of East Syracuse, stating that the Syracuse Rubber Company, manufacturers of rubber tires, had recently erected a manufacturing plant in the vicinity of Lye or Headson creek within the corporate limits of East Syracuse, and that it was his understanding that the village of East Syracuse had granted that company permission to drain the sewage of its plant into Lye creek through the municipal sewer system, and that for this purpose the village was about to allow the connection of this manufacturing establishment with the East Syracuse village system. The complainant further referred to a past report of this Department, in which insanitary conditions were noted and expressed his belief that to add materially to the volume of sewage in the village sewer system would aggravate a condition already objectionable.

Upon investigation it was found that the conditions existing, as regards village sewerage, at the time of the inspection of December 8, 1914, to which reference has been made, and detailed in a report thereof (see 36th Annual Report, Vol 2, page 1077), had in general been only slightly changed. The bulk of the sewage is conducted to a concrete settling tank previously described in connection with the investigation of 1914. This tank is covered with a roof composed of plank, some of which are loose. It is estimated that the volume of sewage entering the tank would receive, if the entire volume of the tank were available, a theoretical detention of 1½ hours. There was in the tank a considerable quantity of sludge and thick tough scum. That it has been the practice to remove these accumulations is shown by quantities of dry sewage solids on nearby land. From this tank the effluent passes through a manhole and into the stream, a distance of about 50 feet. Over the manhole is a small frame building housing a Wallace and Tiernan chlorinating apparatus. The chlorine is applied in the manhole. No provision is made for detention during the process of disinfection other than such as is obtained in the slow current of the creek. The dilution obtained in the waters of the stream effects a similar reduction in the proportion of chlorine. This disinfecting plant supplanted a hypochlorite apparatus which was described in the report of the 1914 investigation.

Recently the village of East Syracuse voted to annex some 39 acres located immediately adjacent to its former east boundary line and upon which is located the new plant of the Syracuse Rubber Company. At this plant it was found that a settling tank, 12 feet x 12 feet in plan, had been built near the freight line right of way of the New York Central railroad. The tank was constructed of vertical plank sheathing held in place by a timber frame. The contents of this tank plainly indicated that sanitary sewage was entering it. The effluent was piped underground 30 feet to a point in the bed of a ditch inside the railroad right of way. It then flowed in this ditch over the right of way a distance of about 400 feet to Headson creek, into which it discharged near the railroad bridge about 700 feet down stream from the point of discharge of the village sewage. No plans showing this tank and method of disposal of sanitary sewage and trade wastes have been submitted to this Department, nor has any application been made by this company or by the village in their behalf for permission to discharge sewage from this industrial plant into the waters of Headson creek. This discharge of sewage into the waters of the State without permission constitutes a violation of section 79 of the Public Health Law. Application should be made immediately by the Syracuse Rubber Company for temporary permission to discharge sewage and wastes from their plant into the waters of Headson creek. This application should be accompanied by plans in duplicate showing details of construction of sewers and disposal plant together with the location of the proposed point of discharge into the creek.

It was stated by Dr. B. F. Chase, Health Officer of the village of East Syracuse, that he understood this method of treatment to be temporary only, and that the village engineer had been instructed to prepare plans for a plant to treat the sewage of this manufacturing establishment. He further stated that the village of East Syracuse had purchased certain property rights, including a right of way across the road bed of the New York Central railroad, for purposes of treatment and disposal of this sewage. It appears from such information as could be obtained that it is intended to discharge the effluent of this plant into the stream at a point about 500 feet down stream from the present point of discharge, or about 1,200 feet down stream from the present village outfall.

In general the slope of the bed of Headson creek is slight and the resulting current moderate, in some places sluggish. After passing under the tracks of the New York Central railroad it passes between the railroad right of way and the rear of a number of houses located on Manlius street. A considerable quantity of suspended solids was seen in the stream in this section. The stream then crosses Manlius and James streets in a well built-up section. Thence it flows in the town of DeWitt in a northeasterly direction mainly through an agricultural section, but passes near several farm houses. About ⅜ of a mile below James street the stream crosses a highway at a point not far distant from a large industrial plant now under construction. This plant is owned by the M. L. Oberdorfer Brass Company. As the proposed location of the sewage disposal plant, shown on the plans approved in 1915, is some ⅜ miles below this highway crossing, it will be possible for the village of East Syracuse to care for the sewage of this section if it appears desirable.

Conclusions and Recommendations

As a result of this investigation, together with the results of previous investigations and data at hand, and after a careful consideration of the various factors involved, I am of the opinion that the sewage discharged into Headson creek by the village of East Syracuse at present does not create a serious and unwarranted pollution of that stream.

I would therefore recommend:

1. That the village of East Syracuse be required to construct trunk sewers and a sewage disposal plant in conformity with the plans approved by this Department on July 23, 1915.
2. That the sewage of the Syracuse Rubber Company, a manufacturing corporation within the corporate limits of the village, be conducted to this trunk sewer at the most suitable point and that it be treated with the sewage of the village of East Syracuse.
3. That the Syracuse Rubber Company prepare and submit plans to this Department showing temporary method of disposal of sewage and wastes together with application for permission to discharge same into Headson creek, as outlined in the body of this report.

I would further recommend that copies of this report be sent to the Sanitary Supervisor of the District, the Board of Health of the village of East Syracuse, the Syracuse Rubber Company, and the complainant.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *August* 16, 1920

Copies of this report were sent on August 17, 1920, to the village authorities and to the Syracuse Rubber Company, and they were urged to carry out the recommendations of the report.

GLENS FALLS

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on the results of an inspection made by an engineer of this Department on October 30, and November 1 and 2, of the alleged insanitary conditions caused by the discharge of sewage into the Sherman Quarry, owned and operated by the F. W. Waite Lime Company, within the city of Glens Falls, Warren county, N. Y., as complained of in a letter received from the Industrial Commission of the State Department of Labor on October 19, 1920.

General Situation

Glens Falls has a population of about 16,500 persons, and is located on the Hudson river about 60 miles north of Albany. The nearest populated places on the Hudson below Glens Falls are the villages of Hudson Falls and Fort Edward. These municipalities are located about 2 and 4 miles respectively below Glens Falls, and have a combined population of about 10,000 persons. Neither of these villages, however, nor any other municipality below them on the river, use the latter as a source of water supply without purification.

Approved Plans

The records of the Department show that plans for a sewer system for the city of Glens Falls were approved on October 14, 1891, as described in our 12th Annual Report. The sewer system provided for by these plans was constructed in general accordance therewith. The system, however, was rapidly outgrown and extensively added to so that new plans were necessary. Such plans were submitted to the Department and received approval on February 27, 1918. These latter plans embraced a complete system of sewage disposal, and included three pumping stations to care for low undeveloped portions of the city. The treatment comprised screen and grit chamber, three settling tanks of the two-story type with five sludge drying beds, and a submerged outfall discharging at a point near the center of the Hudson river. No steps, however, appear to have been taken to install the proposed sewage disposal plant provided for by these 1918 plans.

Original Disposal Conditions

The system approved in 1891 provided for the disposal of sewage by discharging it into a large fissure, crevice, or sink hole in the lime rock around which was built a covered brick tank vented by a central chimney. This tank prevented the horizontal flow of sewage, at times of violent storm discharges, from jumping over the sink hole, and confined the sewage so that its disposal might be fully accomplished without its being seen or odors from it noticed.

Limitations of Original Disposal Method

No point of issue of the sewage from the sink hole crevice was ever discovered, and for many years it served as a satisfactory means of sewage disposal for the city. However, the discharge from the city increased in volume on the one hand and the capacity of the sink hole crevice on the other hand was lessened by deposits therein, of the products of erosion and surface wash carried by the sewers, which were and are largely on the combined system.

Termination of Original Method

About fifteen years ago, when at times the sewage could no longer be accommodated by the crevice, at first a little and before long apparently all of even the dry weather flow, quite possibly despite efforts by the city to clean the sink hole by hose flushing or shooting, found its way down to the river, about a thousand feet distant, through an open channel across the lands of the Sherman Lime Company.

Property Rights at Disposal Site

In about 1906 a lawsuit was brought against the city by the Sherman Lime Company which was understood to have been decided in favor of the latter. This suit related to the pollution of the quarry properties of the Sherman Lime Company by the city. The city consequently purchased from the Sherman company the fee ownership of a considerable tract of land embracing the site of the present pond of sewage near the quarry on the line of the outfall sewer and including all of a wide strip of land between the outlet of the existing sewer and the Hudson river. From this fee ownership there was reserved, however, the right of the Sherman company to quarry some of the lime rock on this property, which right the F. W. Waite Company is said to have secured from the Sherman company. It was especially stipulated that the right to quarry was to be exercised as not to interfere with the Glens Falls sewer system as then or thereafter constructed and maintained.

1918 Outfall Conditions

The conditions resulting in 1918 as the outcome of failing properly to replace this original method of sewage disposal are described in the report of the consulting engineer for the city in that year. This report states that the sewage at that time overflowed the sink hole through an overflow cut in the foundation of the tank building, and dropped over a lime rock channel some 40 feet, then ran through an earth ditch for about one-third of the way to the river, and last flowed rapidly down a steep incline to the latter.

Present General Outfall Conditions

At the time of the inspection the sewage was, as formerly, discharged from a trunk sewer into a large rectangular tank in the bottom of which is the fissure in the rock which at first sufficed to carry away all the sewage but which appears to be so clogged up as to carry away little or none of it. In consequence of this condition the sewage, or the major part of it, flows from the point of discharge from the sewer near the center of the building directly out through the wall in the southeast corner. From here it falls rapidly for a distance of 10 or 20 feet and then runs through a channel with a rocky bed and with more or less precipitous descent into a pond of sewage about 200 feet to 300 feet distant, the overflow from which spreads itself out over the river bank and discharges through open channels, about 200 feet in length, into the river along the shore line.

Area of Impounded Sewage Exposed

This pond seems to be formed from an old quarry bed, and has a width of about 100 feet and a length of about 300 feet. Judging from the depth of other adjacent quarry beds, this pond might be expected to have a depth of from 3 to 6 feet, or a storage capacity approximating 100,000 cubic feet or sufficient for about half a day's storage of the dry weather sewage flow from the entire city. Septic action was observed and bubbles apparently the size of a bucket frequently came to the surface. It is to be borne in mind, however, that since there are no provisions for removing the sludge to drained drying filters, this pond must ultimately become a solid mass of stagnant filth through which the sewer must force a channel.

Outlet from Pond of Sewage

From this pond the sewage overflows through a box culvert under the industrial railroad of the Lime company. The entrance or upper part of this culvert, however, is formed by three 24-inch terracotta pipes, two placed on the lower level, and the third adjoining these but on the adjacent level above. At the time of first observation the two lower pipes were flowing half full at the upper end and about one-third depth at the lower end. A culvert of such design is, of course, in danger of stoppage from quarry brush and debris carried down as well as objects carried by the large trunk sewer. At least one such stoppage is reported to have already occurred and to have been remedied in response to efforts of the health officer.

Sewage Splayed Along the River Bank

Below the discharge of the culvert the sewage spread itself over about an acre of area composed of small pools among the rock fragments lining the river bank, ultimately finding its way into the Hudson. For the time being both the region around the pond and the region around the pools were isolated and free from human habitation though used by workmen. The conditions on a hot summer day would be objectionable to a far more pronounced degree than could be observed at the time of the inspection which occurred on a cool day after two or more days of rainy weather.

Contemplated Quarrying Operations

At the time of the inspections only two or three men were found working in the Sherman quarry and the representative on the ground as well as the general manager stated that it was not expected to have any men working in the quarry after the 6th of November. It was also stated, however, that some time in the early summer of 1921, if and when business conditions justified, some stripping operations might be begun preliminary to resuming further quarrying, the stripped material to be placed near the sewage pond. This will result in the further increasing of the dike or embankment of dirt now about 150 feet wide and 8 feet or more deep lying between this pond and the present quarry.

Infiltrations into Quarry

In the Sherman quarry infiltration of ground water or sewage occurs in fairly large quantities at three points. At two of these three points the infiltration appears to be of sewage, but no sewage seems to enter the quarry from any other points than these two. The quarry itself is of irregular shape, is about 500 feet long from north to south and has a maximum width at least as great. The three points of infiltration mentioned are on the easterly side of the quarry, which is the side between it and the present sewage outfall ditch and pond. At each of these points the infiltration enters from the foot of the rock wall under three feet or more of rock cover over which is 6 feet or more of earth overburden.

Pollution in Quarry

The first of these infiltration points is about 100 feet below the railroad, or about 100 feet down from the upper or northerly end of the quarry. The amount of infiltration here appeared to be about 1½ second feet at the time of the observation. This first stream of infiltration was clear water without observable odor and apparently contained no sewage. At the next point of infiltration there was a flow of about 0.4 of a second foot of sewage of a dark brown color. This flow entered the quarry at a point about midway down on its easterly side, while about 70 feet below this point the third point of infiltration occurred. There a flow of about 0.3 of a second foot of similar sewage entered. None of this sewage contains large particles but all of it is discolored and malodorous and causes deposits of slime and sludge characteristic of sewage.

Source of Pollution

Neither the city engineer nor the health officer accompanying the engineer from this Department on one of the four inspections were able to say with certainty whether the source of this infiltering sewage was the original sink hole crevice or some other crevice at the point of discharge of the trunk sewer or the pond previously mentioned. There seems to be sufficient fall provided from either source. The pond service appeared to be at an elevation of about 10 feet above the water in the Sherman quarry and about 6 or 8 feet above the points of infiltration discharge of the sewage in the quarry, while the point of discharge of the sewage from the trunk sewer was at an elevation of probably 20 to 40 feet above these points of discharge.

Remedies Proposed

The manager of the quarry appeared decidedly of the opinion that the source of pollution was not the pond but the crevice or rock formation near the sink hole, and he said that he expected, before further working the quarry, to deepen an intercepting rock cut near the point of sewer discharge and between it and the pond and thus cut off this source of contamination, and that he would also further prevent the possibility of pollution from the pond, if any, by placing the overburden or top soil yet to be removed between the pond and the present quarry.

Possible Temporary Relief

While it was not mentioned in the discussion at Glens Falls, it appears also that it may prove feasible temporarily to relieve the insanitary condition in the quarry by collecting the portion of the sewage which enters it at its points of entry into the quarry workings, and to convey it by an iron pipe across or around the present workings back to the sewage outfall channel above its outlet into the river, provided the authorities were willing to permit this diversion of sewage through private premises until a more permanent remedy be found.

Cause of Entry of Pollution

The fact that the quarry is polluted by sewage is evident, though the precise point at which the pollution leaves the flow between the sewer mouth and the culvert below the pond may seem in doubt. It further appears that the discharge or seepage of sewage into the quarry is largely due to the quarrying of lime rock particularly along the outlet channel of the sewage below the sink hole, and to the changing of the location of the outlet channel of the sewage by the present owners of the quarry.

Changes in Sewage Outfall Channel

It seems from the report of the consulting engineer of the city, submitted with the plans for sewage disposal in 1919, that less than three years ago there was no pond on the sewage outlet channel below the sink hole, and the description of its course further showed that it was on a different course than is the present course of the outfall channel. Inquiry from the manager of the limestone quarry brought out an explanation which appeared to be about as follows: Two changes were made in the channel through which the city sewage flows. These changes seem to have been made by the Lime company in the outfall channel, and in the outfall tank and building and outfall channel of the city, and are understood to be without official knowledge on the part of the city or of the city engineer.

Original Channel and First Change

The outfall channel in 1918 as described in the report of the consulting engineer referred to, ran directly toward the river much as at present for about 300 feet, but then deflected to the right, or in a westerly direction, about 30 degrees or more and passed under the industrial railroad through a culvert now filled in. The present owners of the quarry, who are reported to be successors to the rights of the Sherman Lime Company, appear to have broken out the west side wall of the tank house over the sink hole, into the center of which tank the trunk sewer discharges, and dug an entirely new channel about 600 feet long from the sewer mouth to the industrial railway, largely along the property line between their property and that of the city, and from about 100 feet to 300 feet west of the old channel of the sewage outfall stream.

Second and Last Channel Change

This new channel, however, used the same old culvert under the industrial railway as did the channel from which the sewage was deflected. To reach this culvert the lower end of the channel was considerably curved. To lessen the sewage seepage when subsequent quarrying operations approached this new line, or for other reasons of their own, the Lime company decided to change the channel again. This they appear to have done by filling in the tank at the sink hole sufficiently to divert or otherwise diverting the flow of the stream of sewage back to somewhere near its former channel in the upper half of its course, while the lower half, instead of being deflected as originally about 30 degrees to the west, was deflected to the east toward the new triple pipe outlet and culvert prepared for it and already described.

Bank Protection of Pond Formed

This new culvert opening, however, was at an elevation so much higher than the quarry hole across which the outfall channel was now deflected that the pond already described was formed in the latter. A dam or bank of clay nearly 100 feet thick was placed by a steam shovel close to the pond and between it and the present workings. Besides this protection, there also remains a berm of about another hundred feet of untouched overburden between this bank and the present workings and adjoining the latter.

Probable Course of Infiltration

As the sewage infiltration flows into the quarry through seams in the rock, it seems probable that none of it penetrated these extensive earth banks, but that on the contrary its entire course between either the sewage outfall channel or the pond and its points of discharge into the present workings lies in seams or crevices in the rock which have been cut. These seams may have been all or partly caused or opened by quarrying or blasting operations, as no material change in the sewage channel seems to have been made by the city itself since the settlement of the case at law previously mentioned.

Conclusions

In conclusion I would state that the investigation showed:

1. That local insanitary conditions existed in the Sherman quarry owned and operated by the F. W. Waite Lime Company due to the infiltration of sewage through openings apparently made by quarrying or across territory disturbed by quarrying operations.
2. That general insanitary conditions existed due to the unusual temporary expedient of discharging untreated raw sewage, through open trenches, directly upon the shore line of the river.

Recommendations

In order to abate the nuisance complained of and to correct the foregoing insanitary conditions, it is recommended:

1. That the leakage of sewage from the Glens Falls sewerage system into the Sherman quarry of the F. W. Waite Lime Company be stopped by the parties who caused or permitted the flow reaching such workings, and that such leakage be prevented from reaching any quarry in which men are or are to be employed.
2. That the city of Glens Falls take steps to install the treatment plant provided for by the plans approved by this Department on February 27, 1918, as soon as possible.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *November* 16, 1920

Copies of this report were sent on November 22, 1920, to the Mayor and Common Council of Glens Falls, to the local Board of Health, to the Sanitary Supervisor, and to the F. W. Waite Lime Company.

GREEN ISLAND

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewerage conditions of the village of Green Island, Albany county, N. Y., made by Mr. W. C. Emigh, Assistant Engineer in this Department, on August 25, 1920. This investigation was made at the request of Dr. H. L. Albrecht, Health Officer of the village.

Green Island is an incorporated village located at the confluence of the Hudson and Mohawk rivers, about three miles above Albany. It has an estimated population at the present time of 4,800 persons. Its water supply is furnished by the Green Island Water Company. It is derived principally from infiltration galleries located on Center Island, a small island between Green Island and Troy. The water is purified by gravity mechanical filters. It is stated by the superintendent of the company that the water consumption of the village is approximately 300,000 gallons per day, all of which is metered.

The sewer system of the village, which was installed in the year 1887, was constructed on the combined plan: that is, the flow of sanitary sewage and storm water runoff is collected in the same set of pipes. Four outfalls are provided, located on Bleecker, Swan, Hamilton, and Saratoga streets respectively. The sizes of sewers at these outfalls are 2′6″ by 3′9″; 1′10″ by 2′9″; 1′8″ by 2′6″; and 15″ respectively. The first three are egg-shaped brick sewers, and the fourth is a circular tile pipe sewer. In the case of each of the brick sewers, the end of the main sewer is above high tide. A short distance back of each of these open ends is located a manhole, at which point the dry weather flow enters a smaller iron pipe and is conveyed therin; at Bleecker street to a point above normal high tide; at Swan street to a point submerged at low tide; at Hamilton street to a point just above low tide. In 1904 it was estimated that the population served by the Bleecker street sewer was about 15 per cent; the Swan street sewer about 50 per cent; the Hamilton Street sewer 29 per cent; and the Saratoga street sewer about 6 per cent of the total. A 15-inch sewer carrying only storm water discharges into the river at the foot of Center street.

It was stated by the village health officer that complaints regarding only the nuisance created by the Hamilton street sewer had been made to him. It was found that this sewer discharges into a channel of the Hudson river lying between Green Island and Center Island. The recent inspection was made about one hour before extreme low tide. At that time it was estimated that the water level in the portion of the channel into which the Hamilton street sewer discharges was approximately 8 inches above the water level in the main channel. At the southerly end a small amount of water was trickling over the gravel bed of the river in a stream about 2 feet wide. At the northerly end a similar stream was about 4 feet wide. It thus appears that this portion of the river is nearly land-locked for several hours before and after extreme low tide.

A large quantity of gas was rising to the surface in this land-locked portion of the river. It is claimed by residents of the village of Green Island that this condition of stagnation has been either created or aggravated by the use of the north end of the channel lying between Green Island and Center Island as a spoil bank during recent dredging operations in connection with the construction of the State Barge canal. It appears, however, from the gravel observed near the bridge spanning the channel that deposition of gravel and sand is likely to occur in this section and that little current would exist even had the spoil not been dumped at the north end.

The Bleecker and Swan street outfalls are located at points which are at all times connected with the main channel but are in slack water at some distance from that channel. Scum was observed upon the surface of the water near these outfalls. The Saratoga street outfall is located in the face of a bulkhead and at a point fully 2 feet above low tide. Sewage from this outfall falls into slack water. A considerable quantity of scum was noted at this point.

Although it was evident that conditions were somewhat worse at and near the Hamilton street outfall, it also appeared that objectionable conditions existed at all of the outfalls. After careful consideration of these conditions I would recommend —

1. That the village of Green Island prepare and submit to this Department for approval plans showing —
   (a) An intercepting sewer so designed as to receive and convey all of the dry weather flow of the sewers now discharging into the river at Bleecker, Swan, Hamilton, and Saratoga streets to a point suitably located for and adapted to the construction of a sewage disposal plant.

(b) Details of a suitable sewage disposal plant for the preliminary treatment of the dry weather flow of sewage before its discharge into the waters of the Hudson river, together with general plans for the more complete treatment of the sewage of the village.

(c) An outfall sewer to convey the effluent of the disposal plant to a point in the channel of the Hudson river so located as to obtain dilution and velocity of stream flow sufficient to avoid the creation of a nuisance.

(d) Outfall severs to convey the storm overflow from each of the existing outfalls to the main channel of the Hudson river.

2. That after the approval of these plans the village proceed to construct and put in operation the works for the preliminary treatment of the sewage and the intercepting and outfall sewers.

I would further recommend that copies of this report be sent to the Board of Health of the village of Green Island, to the president of the Chamber of Commerce of the village, and to the sanitary supervisor of the district.

Respectfully submitted

THEODORE HORTON

ALBANY, N. Y., *September* 10, 1920 *Chief Engineer*

On September 10, 1920, copies of this report were sent to the sanitary supervisor of the district, to the local board of health, and to the president of the Chamber of Commerce of Green Island.

MALTA (Town)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report upon an investigation of sewerage conditions and garbage disposal at Round Lake, Saratoga county, N. Y., made on July 20, 1920, by Mr. A. I. Howd, Assistant Engineer in this Department.

Round Lake is an incorporated association in the town of Malta, Saratoga county, N. Y. It is on the main line of the Delaware and Hudson railroad about 13 miles south of Saratoga Springs. During the summer the population of Round Lake is about 1,500, but during the remainder of the year it is only about 500. The village has a comprehensive sewer system, and a water supply owned by the association and derived from a spring brook about 2 miles from the village.

The Round Lake Association, of which Mr. A. A. Lavery is president, and Mr. John T. Wilmot is superintendent, has a board of nine trustees which pass upon all matters pertaining to the association. The association owns about 200 acres of land in the town of Malta, approximately one-half of which is occupied. There are about 300 camps and houses in the settlement practically all of which were occupied at the time of the inspection. The association leases the land for 99 years with privilege of renewal.

The sewer system for Round Lake was designed by Landreth and Fitzgerald and was constructed in 1887. Storm water was discharged into the sewers originally, but about five years ago practically all the storm water was excluded from the sewers. There are about 1.7 miles of sewer mains, ranging in size from 4 inches to 8 inches. The sewage flows by gravity to a sewage disposal plant located in the northeastern part of the village near the lake. This plant which was constructed about 1890 was designed for the treatment of the sewage by chemical precipitation. At present, however, and for some time, the plant has been operated simply as a series of plain settling tanks. The effluent has been discharged into Round lake.

The sewerage conditions in the village are briefly as follows:

1. The area bounded by Prospect avenue on the east, by Whitfield and Lake avenues on the south, by Simpson avenue on the west, and Saratoga avenue on the north, includes the central and major part of the village and is tributary to the main sewage disposal plant.

2. The section enclosed by Merrill, Thomson, Whitfield, and James avenues is a low area near the lake, and is served almost entirely by cesspools. Some 17 properties in this section are provided with cesspools.

3. There are some 12 properties on Andrews avenue east of Bowman avenue which are served by a 4-inch and 6-inch sewer which discharges into a series of 3 small settling tanks, located near the ice house. The effluent pipe is carried under the Hudson Valley railroad tracks near which the sewage discharges into a ditch and flows through underbrush for about 100 or 200 feet to the lake.

4. That part of the village west of the Delaware and Hudson railroad tracks is served by cesspools, some of which it was learned have effluent pipes connected to a sewer in Washington avenue which in turn empties into the ditch along the Delaware and Hudson railroad tracks. There are some 17 properties in this section provided with cesspools.

5. There are a few houses on Andrews avenue west of Bowman avenue which are too low to be connected with the sewer system and which are provided with cesspools. A cesspool serving the Weld and Freinsberg properties was found to be overflowing and creating insanitary and objectionable conditions. The sewage from these properties should be disposed of in a satisfactory and sanitary manner.

6. A cesspool located in Barker Park, near Wiley avenue and Ninth street, which serves the Boyce and Manson properties on Wiley avenue, was found to be practically full of solid matter and scum. This cesspool should be cleaned out at the earliest possible time and the properties should be connected with the sewer system on Andrews avenue or Lake avenue if possible.

7. The sewage from the property of a Mr. Boucher, on the corner of Whitfield and Ames avenues, discharges onto the ground in the rear of the property and flows through a ditch for about 100 feet seeping into the ground. Since there is no sewer to which the property might be connected, it seems that a leaching cesspool should be constructed to receive and dispose of the sewage from the property.

The sewage disposal plant is housed in a frame building about 50 feet square. As previously pointed out, the works were originally operated as a chemical precipitation plant, but for a number of years the plant, with practically no alterations, has been used as a series of plain settling tanks. The first settling tank is constructed of brick, and is about 25 feet by 50 feet by 6 feet deep. This tank is divided into two compartments, 25 feet by 25 feet, by a brick wall through the center of the tank. The sewage enters each compartment through a 10-inch inlet pipe located in the corner of the tank near the division wall and about 2 feet below the top of the tank. About 10 feet from the inlet pipe in each compartment a brick wall extends transversely across the tank to within about 5 feet of the side wall, and about 15 feet from the inlet pipe another wall extends transversely across the tank from the division wall to the side wall. The sewage flows around the end of the first wall and over the second wall from the end of which bricks have been removed allowing the sewage to flow into the outlet chamber. The sewage leaves each compartment through a pipe provided with a gate near the bottom of the compartment and drops into another tank about 25 feet by 50 feet in plan located at elevation about 5 feet lower than the first tank. In this second tank there are two brick walls partially demolished, which were formerly a part of the chemical precipitation plant, but are of practically no use at present. The sewage leaves the tank through a submerged outlet pipe and discharges through about 50 feet of pipe into an open ditch.

This ditch runs in a southeasterly direction for about 100 feet at which point the sewage flows under the tracks of the Hudson Valley railroad, and about 50 feet farther it flows under a state highway. The sewage then flows through an open ditch for several hundred feet into Round lake, at the northwestern end of the lake. No definite information could be obtained as to the volume of daily sewage flow, but it might be roughly estimated at approximately 100,000 gallons daily at the time of the inspection.

The sewage disposal plant is operated as follows: The gate on the influent pipe to one compartment is opened and the effluent pipe on the same compartment is closed, allowing the sewage to fill the compartment. At the same time the gate on the influent pipe to the other compartment is closed and the effluent pipe opened allowing the compartment to be emptied. Each time an effluent pipe is opened a scoop of chloride of lime (about ½ pound) is thrown on to the sewage of the final settling tank. During the summer the tanks are alternated every 6 hours (except during the night) and during the winter every 12 hours.

Rather than operate the settling tanks on the "fill and draw" plan, it would probably be better and more in accordance with modern practice to operate the tanks on the "continuous flow" plan. This would necessitate only a few minor changes such as the removal of about 5 feet of the second transverse brick wall near the division wall in each of the 25 feet by 25 feet tanks, so that all of the sewage might flow around the wall. An outlet pipe should be provided near the top of each tank instead of at the bottom as at present, and scum boards should be provided about 12 inches from the outlets to prevent scum and floating matter from flowing through the effluent pipe.

At the time of the inspection the tanks contained considerable quantities of scum and sludge, which should be removed from the tanks.

Each of the 25 feet by 25 feet tanks has a capacity of about 55,000 gallons, which would provide a detention period for the sewage if operated on the continuous flow plan of about 6½ hours in each tank, assuming a daily flow of sewage of 100,000 gallons during the summer. A detention period for the sewage of about 6 hours would probably be sufficient, and it would be necessary to use only one tank at a time. The secondary settling tank into which the sewage from the two primary tanks is at present discharged might be put out of operation if the primary tanks are operated by continuous flow, since the primary tanks would furnish sufficient detention of the sewage.

The present method of applying the chloride of lime to the sewage is ineffective and insufficient. As pointed out above, a scoop of chloride of lime is thrown into the sewage each time a tank is changed, which results in only a small portion of the sewage being treated. Assuming the daily flow of sewage to be 100,000 gallons and about ½ pound of chloride of lime applied three times a day, the amount of available chlorine applied to the sewage would only be 0.6 parts per million on the average. A suitable apparatus or mixing device should be installed for making a solution from the chloride of lime and the solution should be uniformly applied to the sewage, preferably in the effluent pipe by means of a constant level feed tank or some other satisfactory apparatus. The effluent from the sewage disposal plant should be treated with not less than 10 parts of chlorine per million parts of sewage, which is equivalent to about 25 pounds of chloride of lime per 100,000 gallons of sewage assuming that the chloride of lime contains about 35 per cent of available chlorine.

The effluent from the sewage disposal plant, as pointed out above, is carried in a pipe only a short distance from the plant, the sewage being discharged into an open ditch through which it flows for some distance to the lake. Since the discharge of sewage into the open ditch is objectionable, the effluent pipe should be continued to deep water in the lake.

In regard to garbage disposal, the inspection disclosed the following facts: Garbage is collected 2 or 3 times a week from hotels and boarding houses and once a week from residences. A charge of 25 cents a can is made for the collection of garbage. No attempt is made to separate the garbage from ashes and rubbish. The association has one dump wagon having a capacity of about 1½ yards, which collects about 10 loads or 15 yards of garbage and rubbish per week.

The garbage and rubbish is dumped on one of two dumps located north of the village. One dump is located in an isolated spot near the sewage disposal plant and the other is several hundred feet west of the plant. There was not much garbage exposed around the dumps and no objectionable conditions were apparent at the time of the inspection.

In view of the above facts the following conclusions may be drawn:

1. That in some sections of Round Lake objectionable conditions are created by the improper disposal of sewage from residences.
2. That the present method of operation of the main sewage disposal plant is not in accordance with modern practice.
3. That the present method of applying chloride of lime to the sewage is ineffective and insufficient.
4. That the discharge of the effluent from the sewage disposal plant into the open ditch is objectionable.

I therefore recommend:

> 1. That the sewage from the Weld and Freinsberg properties be disposed of by some sanitary and satisfactory method; that the cesspool serving the Boyce and Manson properties be cleaned out at once, and that the properties be connected with the sewer system on either Andrews or Lake avenues if possible; and that a proper cesspool be constructed to receive and dispose of the sewage from the Boucher property at Whitfield and Ames avenues, or that the sewage be disposed of by some other satisfactory method.
> 2. That the Round Lake Association consider the practicability of operating the sewage disposal plant as outlined above.
> 3. That a suitable apparatus be installed for the application of hypochlorite of lime to the effluent from the sewage disposal plant, and that the effluent be treated with not less than 10 parts of chlorine per million parts of sewage, or about 25 pounds of chloride of lime per 100,000 gallons of sewage (assuming that the chloride of lime contains about 35 per cent available chlorine).
> 4. That the effluent pipe from the sewage disposal plants be continued to deep water in the lake.

I further recommend that copies of this report be sent to the local Board of Health of the town of Malta, to Dr. James S. Walton, sanitary supervisor of the district, and to the Round Lake Association.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *September* 15, 1920

Copies of this report were sent on September 16, 1920, to the Round Lake Association and to the local board of health, and the association was urged to carry out the recommendations of the report.

ONEONTA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewerage conditions in the northwestern part of the city of Oneonta, Otsego county, N. Y., made by Mr. W. W. Young on June 3, 1920, in response to a complaint received May 29, 1920.

Oneonta is a thriving city on the Susquehanna river in a farm and milk producing district. It is on the Delaware and Hudson railroad. The yards and shops of this company employ between 800 and 1,200 men, many of whom live in the section under investigation, or closely adjoining in the town of Oneonta. The population of the city of Oneonta is 11,582 according to the census of 1920. The water supply is privately owned and is obtained from a lake some miles distant.

The complainants allege that the health of the entire west end of the city is threatened by the insanitary condition caused by overflowing cesspools, and this Department is asked to cause sewers to be built on the lower outer end of Chestnut street and connecting sewers through Morgan and West End avenues to remedy this condition.

At the time of the inspection there was no odor or surface pollution evident on or from any part of this district nor any insanitary odor noticeable in the neighborhood. It seemed, therefore, that the insanitary conditions were not continuous, and subsequent questioning of the health officer and residents brought out the fact that the conditions arose largely from the rise of ground water due to rainfalls at certain seasons being held by the shelf projecting from the side of a mountain which rises to a height of nearly 500 feet just behind this district.

An examination of the locality and of the successive city and sewerage plans was also made. It appeared that this district was not developed at the time the plans for sewerage and sewage disposal were approved in 1912 and 1916 but that it has since grown into four or five blocks of fairly well built up suburban streets. It was found that all of this western section of the village is either constructed along a single street, Chestnut street, which is mainly brick paved and contains a trolley line, or along short streets branching from Chestnut street. About a quarter of a mile from its western end, Chestnut street rises over a knoll which is about 10 feet higher than the low points beyond, between it and the outer line of the city. However, after rising again a comparatively small amount, it slopes downward toward Ceperly avenue which is in the town of Oneonta about 1,000 feet west of the city line and extends toward the river from distant streets.

To connect the sewers from these newly built up streets into Chestnut street, and to build a sewer along Chestnut street to collect sewage from this district, would cost approximately the same by whatever method might be chosen to provide an outlet connection. In order, however, to conduct this sewage back along Chestnut street to the present sewers through the knoll or high point in the manner requested by the complainants, would require at least 1,000 feet of sewer to be laid where there is already a sewer at a higher level. This new low level sewer would also involve cuts of between 15 and 19 feet deep in most places and necessitate construction along a narrow brick paved street and beside a trolley track.

Another remedy of this situation would be that originally provided by the plans for sewerage approved in 1912. This original 1912 plan provided a sewer about a mile long across private right of way to be acquired by the city. The right of way then contemplated was across railroad property. If this or some other line or right of way acquired by the city be shortened by entering the river at a different point than is planned for the effluent from the city disposal works to enter, either a separate treatment plant must be installed or the sewer should be constructed at such an elevation that it can be connected by gravity to the proposed approved municipal plant when built.

A third remedy or method is to pump the sewage by establishing a low lift pump or pressure chamber and pumping the sewage about a distance of 1,000 feet up over the knoll on Chestnut street with a total lift of about 30 feet. The tributary area is only about 60 acres and it seems to be unnecessary to provide for any additional territory which might become tributary by annexation.

The ground was also examined with the view of the possibility of utilizing a fourth method or remedy to be effected by opening a new street on the low side of Chestnut street and conducting the sewage back along this to the existing sewer beyond the hill or rise on Chestnut street; but the quick descent of the bank and the houses already built on it on the low side of Chestnut street seemed to interfere and make this fourth remedy, or even the construction of a castiron pipe on a right of way along the lower side of Chestnut street impracticable on account of the many interests involved and topography of the ground.

In conclusion, the matter seems largely a local one of sewer extension, and the method of this sewer extension one entirely for local decision. It does not appear essential from the viewpoint of this Department which of these or what other satisfactory method may be adopted of providing sewers for this section; but there does appear to exist a recurrent nuisance which in my opinion can best be permanently remedied by sewer extensions.

I therefore recommend:

1. That the city engineer be authorized to prepare and submit to this Department for approval plans providing for sewers for this district at an early date.
2. That should the city decide not to pump or connect by gravity to the existing sewers but to construct an independent outlet sewer to the river, the sewage collected by such sewer should be passed through and treated in a settling tank, plans for which must be submitted to and receive the approval of this Department.
3. That until such time as sewers are provided in this section of the city, steps be taken by the local board of health, in accordance with the provisions of the Public Health Law, to abate any public nuisance created by the overflow of cesspools in this section.

I would further recommend that copies of this report be sent to the city authorities, to Dr. George W. Augustin, health officer, to Dr. Halsey J. Ball, sanitary supervisor of the district, and to the complainants.

Respectfully submitted
THEODORE HORTON
ALBANY, N. Y., *September* 7, 1920 *Cief Engineer*

On September 13, 1920, copies of this report were sent to the mayor and common council and to the local board of health of the city of Oneonta.

WOODRIDGE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an inspection of sewerage conditions in the incorporated village of Woodridge, Sullivan county, made on December 17, 1919, by Mr. C. A. Howland, Assistant Engineer in this Department. This inspection was made in response to a request received from the board of trustees of Woodridge for information in regard to sewerage for the village.

Woodridge is situated in the mountainous region of the central eastern part of Sullivan county, on the main line of the New York, Ontario and Western railroad, about 26 miles northwest of the city of Middletown. In the central part of the village the elevation above mean sea level is about 1,150 feet, while the surrounding mountains rise to elevations of 1,360 and 1,440 feet above mean sea level. The population of the village, which according to the State census of 1915 was 900, increases to several times this number during the summer vacation months. This increase is due to the influx of summer visitors from the large cities, especially New York city. The population during the summer is somewhat indeterminate, but from information furnished the engineer at the time of the inspection the number may be estimated to be from 3,000 to 3,500.

It appears from a map of the village surveyed in 1917 that the corporation is about 1.3 miles in length and 0.64 mile wide, comprising an area of about 0.83 square mile, or nearly 533 acres. The village proper is somewhat long and narrow and lies in the central part of this area. The ground surface of the village slopes toward two watercourses, approximately four-fifths of the village being in the watershed of Sandbury creek, while the western end of the village extends into the watershed of a small tributary of the Neversink river. The number of houses in the village was given as 125, and at the time of the inspection it was noticed that several buildings were in the course of construction, indicating growth in the village. There appears to be only one small manufacturing establishment, the remainder of the buildings being stores, hotels, boarding houses, residences, and similar places.

Woodridge is provided with a public water supply obtained by gravity from a pond about 1½ miles north of the village center. An inspection was made of this water supply by a representative of this Department in the summer of

1918, and in the report upon that inspection it is stated that the number of service taps in the village was 115.

The village of Woodridge is not provided with a public sewer system, and no information was obtained at the time of the inspection which would indicate that private sewers had been constructed in any of the village streets. It appears that in practically all of the buildings which are supplied with the village water modern plumbing fixtures, including flush closets, have been installed. The sewage from these buildings is discharged into cesspools, and in 1 or 2 instances into a small watercourse. The soil conditions in the village are not suitable for the disposal of sewage in cesspools. In parts of the village the top soil is underlain by rock at a depth of from 3 feet to 4 feet, while in other parts of the village the soil is somewhat sandy. The engineer observed, at a place where a large cesspool was in course of construction, that the sand contained a considerable percentage of clay. The soil is therefore somewhat impervious and does not readily absorb the sewage.

The result is that cesspools overflow and new cesspools are continually being constructed in an effort to dispose of the sewage. In the closely built up portions of the village the area available for cesspools is restricted and in some cases has apparently been practically exhausted. A permanent method for the disposal of sewage is therefore not provided by the construction of these cesspools. Conditions of nuisance, which constitute in many cases a menace to the health of the community, result from the overflowing of cesspools. The engineer observed, in one instance, a small watercourse into which several cesspools overflow. A marked odor characteristic of sewage was noticed arising from this stream although the day was very cold. Obstructions in the watercourse cause the sewage to flood an area in the rear of several buildings.

Instances were observed where sewage overflows from cesspools into the road ditches, and a number of cesspools also overflow over the surface of the ground into the railroad cut. These insanitary conditions are general throughout the village, and are becoming more and more acute as the volume of sewage to be cared for increases and the area available for cesspools becomes more restricted. It is apparent that the considerable amounts of money which are being expended for the construction of these cesspools do not provide a permanent method for the disposal of the sewage of the village, and as some of these cesspools are from 10 to 15 feet in diameter and from 6 to 15 feet deep their construction is comparatively costly. The engineer was informed that no serious epidemic of disease which can be traced to the insanitary conditions has occurred in the village. If this is the case it does not argue that such an epidemic may not occur in the future if the existing insanitary conditions are allowed to continue. The occurrence of an epidemic of disease would detract seriously from the reputation of the village as a summer resort.

From the above description it is apparent that the only permanent solution for the present situation in regard to the disposal of sewage in the village of Woodridge is to construct a properly designed system of sewers and sewage disposal. Such a system would provide a permanent relief from the existing conditions, would safeguard the health of the community and prevent the occurrence of conditions of nuisance such as now exist, and would provide for any future growth of the village. The cost of such a system of sewerage and sewage disposal should not prove prohibitive when it is considered that long term bonds, on which the annual per capita payments would be comparatively small, could be issued to provide funds for the construction of such a system.

The procedure for the construction of a sewerage system and sewage disposal in a village is described in sections 260 *et seq.* of article XI of the Village Law. This law requires that plans for sewers shall include all parts of the village, but provision is also made in the law whereby parts of the sewer system which it is unnecessary to construct at the present time in order to care for the sewage of the village may be temporarily omitted from construction, but such omission requires the permission of the State Commissioner of Health. The plans for sewerage and sewage disposal must also be submitted to the State Commissioner of Health and receive his approval before the system is constructed.

It appears from data gathered at the time of the inspection that the largest part of the village drains naturally toward Sandbury creek. This creek discharges into a large pond just below the village. The engineer was informed that this pond is to be developed for pleasure resort purposes. In such a case it would not be advisable to discharge sewage into the pond, and it would probably therefore be necessary, in the event that the sewage of the village was discharged into this stream, to place the sewer outlet below the outlet of the pond.

The area of the watershed of Sandbury creek at the outlet of the pond is nearly 6 square miles while the watershed area at the inlet of the pond is about 4 square miles. By carrying the sewer outlet below the outlet of the pond the benefit of the greater dilution due to the greater volume of flow in the stream at this point would be obtained. However, an approximation of the minimum dry weather flow to be expected in this stream, from available data from other streams in the State, indicates that the volume of flow in the stream would be inadequate to dispose of the sewage from the maximum population in the village by dilution, and that treatment of the sewage in a disposal plant before it is discharged into this stream would be necessary. There are no records in this Department to show that a public water supply is derived from the Sandbury creek below Woodridge, therefore the question of the pollution of a public water supply does not arise in regard to the use of this stream, but Sandbury creek passes through the village of Mountaindale, about 2½ miles below Woodridge, and it is important that the creation of conditions of nuisance due to the discharge of sewage into this stream be prevented.

The northern end of the village lies within the watershed of a small tributary of the Neversink river. This small tributary has a watershed area of about ¾ square mile above the point at which it crosses a road in the northern end of the village. In order to carry the sewer outlet to the Neversink river, it would be necessary to cover an additional distance of about 1½ miles.

More extensive study than could be made at the time of this inspection is necessary in order to determine the most advantageous system of sewers to be adopted for the village. It would be possible to dispose of the sewage of the small northern area by pumping into the sewer system of the rest of the village if this sewage is discharged into the Sandbury creek, or to dispose of it in a separate sewage disposal plant, the effluent from which might be discharged into the small tributary of the Neversink river. On the other hand, the relative cost of construction and maintenance of a sewage disposal plant to treat the sewage before it is discharged into Sandbury creek, or of a pumping plant to discharge all of the sewage into the Neversink river, including the cost of rights of way to the river, should be considered. Part of the water supply of the village of Port Jervis is taken from the Neversink river at a considerable distance below this point. This supply is chlorinated. The relative costs of the several possible methods should be compared. It will also be necessary to determine the degree of treatment necessary for the sewage before it is discharged into a watercourse. Provision should be made in designing the sewer system and sewage disposal to care for the considerable increase in population during the summer months, and also to provide for a reasonable increase in population in the village in the future.

It is obvious that careful study is necessary in order to design properly the most economical and efficient system of sewers and sewage disposal for the village, and a competent engineer should therefore be employed by the village to undertake this work. The urgent necessity for such a step on the part of the village authorities is apparent from the description of the conditions existing in the village. Furthermore, the village should complete the necessary financial arrangements and should proceed as rapidly as possible with the construction of the system of sewers and sewage disposal. A permanent benefit, protection to the health of the community, and relief from the existing conditions of nuisance would be obtained at a cost which should not be prohibitive.

In view of the existing conditions in regard to sewage disposal in the village of Woodridge, and after a careful consideration of the local and general requirements in regard to the disposal of sewage from this village, I beg to make the following recommendations:

1. That the village authorities be advised to employ a competent sanitary engineer at once to design a system of sewerage and sewage disposal for the village, plans for which should be submitted to this Department for approval as required by the Village Law.
2. That the village authorities be further advised to construct the system of sewerage and sewage disposal as soon as possible after the plans therefore have been submitted to and have received the approval of this Department.

Respectfully submitted

THEODORE HORTON

ALBANY, N. Y., *January* 17, 1920 *Chief Engineer*

On January 19, 1920, copies of this report were sent to the village president and to the local board of health of Woodridge.

In addition to the above, inspections were made or advice was given through correspondence in matters relating to sewerage and sewage disposal at the following places:

Alfred, Garden City, Gasport, Monroe, Saratoga Springs (State Reservation Baths), Stillwater and Tannersville.

PROTECTION OF PUBLIC WATER SUPPLIES

ENACTMENT AND ENFORCEMENT OF RULES AND REGULATIONS FOR THE PROTECTION OF PUBLIC WATER SUPPLIES

Under section 70 of the Public Health Law the State Department of Health may make rules and regulations for the protection from contamination of any public supply of potable water and its source in the State, and the work of preparing these rules and regulations forms one of the important duties of the Engineering Division of the Department. The rules and regulations are enacted at the request of the authorities in charge of the water supply, made voluntarily or as a result of the recommendations of this Department or requirements by the Conservation Commission. On the receipt of such a request the supply is carefully investigated by a representative of the Engineering Division and the local and general conditions given careful consideration and rules and regulations prepared properly to protect the supply. For the enforcement of such rules and regulations when enacted and published, sections 70, 71, and 73 of the Public Health Law prescribe a definite procedure, the carrying out of which rests largely with the waterworks officials acting in conjunction with this Department and the local health boards.

Of the 540 odd water supplies in the State, 86, not including New York city, are protected by rules and regulations prepared and enacted by this Department. During the year 1920 rules and regulations were enacted for the villages of Monroe and Stamford, and rules and regulations, amending those previously made, were enacted for the village of Peekskill. In addition to these rules and regulations enacted and amended, rules and regulations were prepared for the villages of Canton and Hobart, but have not yet been enacted, and the matter of enacting rules and regulations for Beacon, Rochester, Saratoga Springs, and Wappingers Falls has been under consideration.

The rules and regulations enacted for the protection of the water supplies of Kingston and Watervliet during 1919, and for Albion during 1918, were published, as required by law, in newspapers of the counties in which the districts affected are located, during the year 1920, and proof of such publication furnished to this Department.

MONROE

Rules and regulations for the protection from contamination of the public water supply of the village of Monroe, Orange county, enacted by the New York State Department of Health under chapter 49 of the Laws of 1909, constituting chapter 45 of the Consolidated Laws, as finally amended by chapter 665 of the Laws of 1915 (Public Health Law).

Rules and Regulations

The rules and regulations hereinafter given, duly made and enacted in accordance with the provisions of section 70, 71, 72, and 73 of chapter 45 of the Consolidated Laws (Public Health Law), as heretofore set forth, shall apply to Mombasha Lake and to all watercourses tributary or ultimately discharging into said Mombasha Lake, these bodies of water being sources of the public water supply of the village of Monroe, Orange county, New York. The term "lake" wherever used in these rules is intended to mean and refer to Mombasha, which serves as the source of this public water supply. The term "watercourse" wherever used in these rules is intended to mean and include every spring, stream, ditch, gutter, or to other channel of every kind, the waters of which when running whether continuously or occasionally eventually flow or may flow into the public water supply of the village of Monroe.

Wherever a linear distance of a structure or object from the lake or from a watercourse is mentioned in these rules, it is intended to mean the shortest horizontal distance from the nearest point of the structure or object to the highwater mark of the lake or to the edge, margin,' or precipitous bank forming the ordinary highwater mark of such watercourse.

Privies Adjacent to Mombasha Lake or Any Watercourse

1. No privy, privy vault, pit, cesspool, or any other receptacle of any kind used for either the temporary storage or the permanent deposit of human excreta shall be constructed, placed, maintained, or allowed to remain within seventy-five (75) feet of Mombasha lake or any watercourse tributary to the public water supply of the village of Monroe.

2. No privy, privy vault, pit, cesspool, or any other receptacle used for the permanent deposit of human excreta shall be constructed, located, placed, maintained, or allowed to remain within two hundred and fifty (250) feet of Mombasha lake or any watercourse tributary to the public water supply of the village of Monroe.

3. No cesspool, pit, or other receptacle of any kind used for the temporary storage of human excreta or sewage shall be constructed, located, maintained or allowed to remain between the limiting distance prescribed by rule (1) and the limiting distances prescribed by rule (2) unless said cesspool, pit, or other receptacle is so arranged and equipped that the said excreta or sewage are at once removed by pump or other satisfactory means through watertight pipes or conduits to some proper place of ultimate disposal, as hereinafter provided; or unless suitable removable vessels or receptacles for the temporary storage of said human excreta or sewage are provided and at all times maintained in an absolutely watertight condition and in such manner as to permit of convenient removal of said excreta or sewage to some place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid removable receptacles permitted under rule (3) shall be removed and the receptacles thoroughly cleaned and deodorized as often as may be found necessary to maintain the privy in proper sanitary condition and effectually to prevent any overflow upon the

soil or upon the foundation or floor of the privy. In effecting this removal the utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal hereinafter specified, and that the contents, while being transferred from the privy to the place of disposal, shall be thorougholy covered and that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

5. Unless otherwise specifically ordered or permitted by the State Department of Health, the excreta collected in the aforesaid removal receptacles permitted under rule (3) shall, when removed, be disposed of by burying in trenches or pits at a depth of not less than 18 inches below the surface and at a distance not less then five hundred (500) feet from Mombasha lake or any watercourse tributary to the public water supply of the village of Monroe.

6. Whenever, owing to the character of the soil or of the surface of the ground, or owing to the height or flow of subsoil or surface water, or other special local conditions, it is considered by the State Commissioner of Health that excremental matter from any privy or aforesaid recptacles, or from any trench or place of disposal or the garbage or wastes from any dump, may be washed over the surface or through the soil in an imperfectly purified condition into the lake or any watercourse, then the said privy or receptacles for excreta or the trench or place of disposal or the said garbage or waste dump, shall, after due notice to the owner threof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Commissioner of Health.

Sewage, House Slops, Sink Wastes, etc.

7. No house slops, bath water, sewage, or other excretal matter from any water closet, privy, cesspool, or other source shall be thrown, placed, led, conducted, discharged, or allowed to escape or flow in any manner either directly or indirectly, into Mombasha lake or into any watercourse tributary to the public water supply of the village of Monroe; nor shall any such matters be thrown, placed, led, discharged, or allowed to escape beneath the surface except into watertight receptacles, the contents of which are to be removed as provided by rule (4) within two hundred and fifty (250) feet of the lake or any watercourse tributary to the public water supply of the village of Monroe.

8. No garbage, putrescible matter, kitchen or sink wastes, refuse or waste water, from any creamery, cheese factory, laundry, nor water in which milk cans, utensils, clothing, bedding, carpets, or harness have been washed or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into Mombasha lake or in any watercourse, nor shall any such liquid or solid refuse or waste be thrown, discharged, or allowed to escape or remain upon the surface of the ground or to percolate into or through the ground below the surface in any manner whereby the same may flow into the lake or into any watercourse within a distance of one hundred (100) feet from the lake or any watercourse tributary to the public water supply of the village of Monroe.

9. No clothing, bedding, carpets, harnesses, vehicles, receptacles, utensils, nor anything that pollutes water, shall be washed, rinsed, or placed in Mombasha lake or in any watercourse.

Bathing, Animals, Manure, Compost

10. No person shall be allowed to bathe in Mombasha lake or in any watercourse, nor shall any animals or poultry be allowed to stand, wallow, wade, or swim in the lake nor be washed therein.

11. No stable for cattle or horses, barnyard, hog yard, pig pen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile or compost heap, shall be constructed, placed, maintained, or allowed to remain with its nearest point less than seventy-five (75) feet from Mombasha lake or any watercourse tributary to the public water supply

of the village of Monroe; and none of the above named objects or sources of pollution shall be so constructed, placed, maintained, or allowed to remain where or in such a manner that the drainings, leachings or washings from the same may enter the lake or any such watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainings, or washings shall have percolated over or through the soil in a scattered dissipated form, and not concentrated in perceptible lines of drainage for a distance of not less than seventy-five (75) feet from the lake or any watercourse tributary to the public water supply of the village of Monroe.

12. No human excreta and no compost or other matter containing human excreta shall be thrown, placed, or allowed to escape into Mombasha lake or into any watercourse, nor to be placed, piled, or spread upon the surface of the ground at any point on the watersheds tributary to the public water supply of the village of Monroe, nor shall such human excreta or compost or other matter containing human excreta be dug or buried in the soil at a less depth than 18 inches below the surface nor within a distance of two hundred and fifty (250) feet from Mombasha lake or any watercourse tributary to the public water supply of the village of Monroe; and no manure or compost of any kind shall be placed, piled or spread upon the ground within a distance of fifty (50) feet from the lake or watercourse tributary to the public water supply of the village of Monroe.

13. No decayed or fermented fruit or vegetables, cider mill waste, roots, grain or other vegetables refuse of any kind shall be thrown, placed, discharged, or allowed to escape or pass into Mombasha lake or into any watercourse; nor shall they be thrown, placed, piled, maintained, or allowed to remain in such places that the drainage, leachings or washings therefrom may flow by open, blind, or covered drains or channels of any kind into the lake or into any watercourse without first having passed over or through such an extent of soil as properly to have been purified; and in no case shall it be deemed that sufficient purification has been secured unless the above mentioned drainings, leachings, or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than fifty (50) feet before entering the lake or any watercourse tributary to the public water supply of the village of Monroe.

Dead Animals, Offal, Manufacturing Wastes, etc.

14. No dead animals, bird, fish, or any part thereof, nor any offal or waste matter of any kind, shall be thrown, placed, discharged, or allowed to escape or to pass into Mombasha lake or into any watercourse. Nor shall any such material or refuse be so located, placed, maintained, or allowed to remain that the drainage, leachings, or washings therefrom may reach the lake or any such watercourse without having first percolated over or through the soil in a scattered dissipated form and not concentrated in perceptible lines of drainage for a distance of two hundred (200) feet from the lake or any watercourse tributary to the public water supply of the village of Monroe.

Fishing, Boating, Ice Cutting, Trespassing, etc.

15. No fishing from boats or through the ice, and no ice cutting, shall be allowed upon the waters of Mombasha lake. No boating of any kind or any trespassing whatever shall be allowed in or upon the waters of said lake except by members of the board of trustees of the village of Monroe or its authorized representatives in the performance of necessary and lawful duties; or by the Sterling Iron Company or its authorized representatives for the purpose of operating gates or other necessary duties in connection with the regulation of the water power derived from said lake; and all such operations shall be carried out in strict accordance with these rules and regulations and under the supervision of the board of trustees of the village of Monroe, and in such manner as will cause no pollution of the lake or the water supply of the village of Monroe derived therefrom.

Labor Camps

16. No temporary camp, tent, building, or other structures for housing laborers engaged on construction work or for other purposes shall be located, placed, or maintained within a distance of five hundred (500) feet from the lake or any watercourse tributary to the public water supply of the village of Monroe.

Cemeteries

17. No interment of a human body shall be made within a distance of three hundred (300) feet from Mombasha lake or from any watercourse tributary to the public water supply of Monroe.

Inspections

18. The board of trustees of the village of Monroe shall make regular and thorough inspections of the lake, streams, and drainage areas tributary thereto for the purpose of ascertaining whether the above rules and regulations are being complied with, and it shall be the duty of said board of trustees to cause copies of any rules and regulations violated to be served upon the person violating the same with notices of such violations, and if such persons served do not immediately comply with the rules and regulations it shall be the further duty of the board of trustees promptly to notify the State Commissioner of Health of such violations. The board of trustees shall report in writing annually on the 1st of January the results of the regular inspections made during the preceding year, stating the number of inspections which have been made, the number of violations found, the number of notices served, and the general condition of the watershed at the time of the last inspection.

Penalty

19. In accordance with section 70 of chapter 45 of the Consolidated Laws (Public Health Law), the penalty for each and every violation of or noncompliance with any of these rules and regulations which relate to a permanent source or act of contamination is hereby fixed at one hundred dollars ($100).

The foregoing rules and regulations for the protection from contamination of the public water supply of the village of Monroe are hereby duly made, ordained, and established on this 9th day of November, 1920, pursuant to chapter 45 of the Consolidated Laws (Public Health Law) of the State of New York, as finally amended by chapter 665 of the Laws of 1915.

M. NICOLL, JR.
ALBANY, N. Y. *Acting State Commissioner of Health*

The required publication of these rules and regulations at least once a week for six consecutive weeks in at least one newspaper in Orange county was not completed during 1920.

PEEKSKILL

Rules and regulations for the protection from contamination of the public water supply of the village of Peekskill, Westchester county, from the Peekskill Hollow creek, enacted by the New York State Department of Health under chapter 49 of the Laws of 1909, constituting chapter 45 of the Consolidated Laws, as finally amended by chapter 665 of the Laws of 1915 (Public Health Law). These rules and regulations supersede those enacted by the New York State

Department of Health for the protection from contamination of the water supply of the village of Peekskill on August 19, 1897, and amended on April 6, 1912.

Rules and Regulations

In accordance with the provisions of the Public Health Law, constituting chapter 45 of the Consolidated Laws, the rules and regulations for the protection of the public water supply of the village of Peekskill enacted on August 19, 1897, and amended on April 6, 1912, are hereby rescinded, and the rules and regulations hereinafter given, duly made and enacted, shall be substituted therefor.

The following rules and regulations shall apply to all natural and artificial reservoirs on the Peekskill Hollow creek and all watercourses tributary thereto or ultimately discharging into said reservoirs, those bodies of water being sources of the public water supply of the village of Peekskill, in Westchester county, New York. The term "reservoir" wherever used in these rules is intended to mean and refer to all storage and impounding reservoirs on the Peekskill Hollow creek which are tributary to or which serve as sources of this public water supply or to any additional reservoir which may be constructed or used for the purpose of this public water supply. The term "watercourse" wherever used in these rules is intended to mean and include every spring, pond (other than the artificial reservoirs and filter basins), stream, ditch, gutter, or other channel of every kind, the waters of which, when running whether continuously or occasionally, eventually flow, or may flow, into the public water supply of the village of Peekskill.

Wherever a linear distance of a structure or object from a reservoir or from a watercourse is mentioned in these rules, it is intended to mean the shortest horizontal distance from the nearest point of the structure or object to the high-water mark of a reservoir, or to the edge, margin, or precipitous bank forming the ordinary high-water mark of such watercourse.

Privies Adjacent to Any Reservoir or Watercourse

1. No privy, privy vault, pit, cesspool, or any other receptacle of any kind used for either the temporary storage or the permanent deposit of human excreta shall be constructed, placed, maintained, or allowed to remain within fifty (50) feet of any reservoir or watercourse at any point within two (2) miles upstream from the intake of the Peekskill waterworks; nor shall any such privy, privy vault, pit, cesspool, or other receptacle for the deposit of human excreta be constructed, placed, located, maintained, or allowed to remain within twenty-five (25) feet of any reservoir or any watercourse at points distant more than two (2) miles upstream from the intake of the Peekskill waterworks.

2. No privy, privy vault, pit, cesspool, or any other receptacle used for the permanent deposit of human excreta, shall be constructed, located, placed, maintained, or allowed to remain within one hundred (100) feet of any reservoir or any watercourse tributary to the public water supply of the village of Peekskill.

3. No cesspool, pit, or other receptacle of any kind used for the temporary storage of human excreta or sewage shall be constructed, located, maintained, or allowed to remain between the limiting distances prescribed by rule (1) and the limiting distances prescribed by rule (2) unless said cesspool, pit, or other receptacle is so arranged and equipped that the said excreta or sewage are at once removed by pump or other satisfactory means through watertight pipes or conduits to some proper place of ultimate disposal, as hereinafter provided, or unless suitable removable vessels or receptacles for the temporary storage of said human excreta and sewage are provided and at all times maintained in an absolutely watertight condition and in such manner as to permit of convenient removal of said excreta or sewage to some place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid removable receptacle permitted under rule 3 shall be removed and the receptacles thoroughly cleaned and deodorized as often as may be found necessary to maintain the privy in proper sanitary condition and effectually to prevent any overflow upon the soil or upon the foundations or floor of the privy. In effecting this removal the utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal hereinafter specified, and that the contents, while being transferred from the privy to the place of disposal, shall be thoroughly covered and that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

5. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid temporary receptacles permitted under rule 3 shall, when removed, be disposed of by burying in trenches or pits at a depth of not less than 18 inches below the surface and at a distance not less than five hundred (500) feet from any reservoir or any watercourse tributary to the public water supply of the village of Peekskill.

6. Whenever, owing to the character of the soil or of the surface of the ground, or owing to the height or flow of subsoil or surface water, or other special local conditions, it is considered by the State Commissioner of Health that excremental matter from any privy or aforesaid receptacles, or from any trench or place of disposal, or the garbage or wastes from any dump, may be washed over the surface or through the soil in an imperfectly purified condition into any reservoir or watercourse, then the said privy or receptacles for excreta or the trench or place of disposal of the said garbage or waste dump shall, after due notice to the owner thereof, be removed to such greater distance or to such place as shall be considered safe and proper by the State Commissioner of Health.

Sewage House Slops, Sink Wastes, etc.

7. No house slops, bath water, washings from the bodies of human beings or animals, sewage, or other excretal matter from any water closet, privy, cesspool, or other source, except the purified effluent from a properly constructed sewage disposal plant approved by the State Department of Health, as required by law, shall be thrown, placed, led, conducted, discharged, or allowed to escape or flow in any manner either directly or indirectly into any reservoir or any watercourse tributary to the public water supply of the village of Peekskill; nor shall any such matters be thrown, placed, led, discharged. or allowed to escape or flow onto the surface of the ground or into the ground beneath the surface, except into watertight receptacles the contents of which are to be removed as provided by rule 4, within one hundred (100) feet of any reservoir or any watercourse tributary to the public water supply of the village of Peekskill.

8. No garbage, putrescible matter, kitchen or sink wastes, refuse or waste water, from any creamery, cheese factory, laundry, nor water in which milk cans, utensils, clothing, bedding, carpets or harnesses have been washed, or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into any reservoir or watercourse; nor shall any such liquid or solid refuse or waste be thrown, discharged, or allowed to escape or remain upon the surface of the ground or to percolate into the ground or through the ground below the surface in any manner whereby the same may flow into any reservoir or watercourse within a distance of fifty (50) feet from any reservoir or any watercourse tributary to the public water supply of the village of Peekskill.

9. No clothing, bedding, carpets, harness, vehicle, receptacles, utensils, nor anything that pollutes water, shall be washed, rinsed, or placed in any reservoir or watercourse.

Bathing, Animals, Manure, Compost, etc.

10. No person shall be allowed to bathe in any of the streams, lakes, ponds, or reservoirs tributary to the water supply of the village of Peekskill except in Oscawana lake, Mohegan lake, Osceola lake, Brant lake, Clear

lake, Mud lake, Barger pond, and tributaries thereof; nor shall any person be allowed to bathe in Oscawana lake, Mohegan lake, Osceola lake, Brant lake, and Barger pond within 500 feet of the outlets thereof. No animal or poultry shall be allowed to stand, wallow, wade, or swim in any stream, lake, pond, or reservoir tributary to said water supply, nor allowed to be washed therein. No watering place shall be maintained in such a way as to pollute by muddy leachings or excretal matters any stream tributary to the public water supply of the village of Peekskill.

11. No stable for cattle or horses, barnyard, hogyard, pigpen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile or compost heap, shall be constructed, placed, maintained, or allowed to remain with its nearest point less than one hundred (100) feet of any reservoir, or fifty (50) feet of any watercourse, at any point within two (2) miles upstream from the intake of the Peekskill waterworks; nor shall any such structures or places be constructed, placed, maintained, or allowed to remain within fifty (50) feet of any reservoir or any watercourse at points distant more than two (2) miles upstream from the intake of the Peekskill waterworks; except in the case of islands in Oscawana lake, where no such structures or places shall be constructed, placed, maintained, or allowed to remain within twenty-five (25) feet of the highwater mark in the lake. None of the above named objects or sources of pollution shall be so constructed, placed, maintained, or allowed to remain where or in such a manner that the drainings, leachings, or washings from the same may enter any such reservoir or watercourse without first having been passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainage, leachings, or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage for distances not less than those specified in the foregoing part of this rule.

12. No human excreta and no compost or other matter containing human excreta shall be thrown, placed, or allowed to escape into any reservoir or watercourse, nor to be placed, piled, or spread upon the ground at any point on any water shed tributary to the public water supply of the village of Peekskill; nor shall human excreta, compost, or other matter containing human excreta be dug or buried in the soil at a less depth than 18 inches below surface nor within a distance of one hundred (100) feet from any reservoir or any watercourse tributary to the public water supply of the village of Peekskill, and no manure or compost of any kind shall be placed, piled or spread upon the ground within a distance of twenty-five (25) feet from any reservoir or any watercourse tributary to the public water supply of the village of Peekskill.

13. No decayed or fermented fruit or vegetables, cider mill wastes, roots, grain or other vegetable refuse of any kind shall be thrown, placed, discharged or allowed to escape or pass into any reservoir or watercourse, nor shall they be thrown, placed, piled, maintained or allowed to remain in such places that the drainage, leachings or washings therefrom may flow by open, blind or covered drains or channels of any kind into any reservoir or watercourse without first having passed over or through such an extent of soil as properly to have been purified; and in no case shall it be deemed that sufficient purification has been secured unless the above mentioned drainage, leachings, or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than fifty (50) feet before entering any reservoir or any watercourse tributary to the public water supply of the village of Peekskill.

Dead Animals, Offal, Manufacturing Waste, etc.

14. No dead animals, bird, fish, or any part thereof, nor any offal or waste matter of any kind, shall be thrown, placed, discharged, or allowed to escape or to pass into any reservoir or watercourse. Nor shall any such material or refuse be so located, placed, maintained, or allowed to remain that the

drainage, leachings, or washings therefrom may reach any such reservoir or watercourse without having first percolated over or through the soil in a scattered, dissipated form and not concentrated in perceptible lines of drainage, for a distance of one hundred (100) feet from any reservoir or any watercourse tributary to the public water supply of the village of Peekskill.

Fishing, Boating and Ice Cutting

15. No boating of any kind, nor fishing from boats or through the ice, nor any trespassing whatever, shall be allowed in or upon the waters or ice of any reservoir of the village of Peekskill or of Oscawana lake, Mohegan lake, Osceola lake, Brant lake or Barger pond within 500 feet of the outlets thereof, nor shall any fishing, boating or ice cutting be done in any manner that may pollute the waters of this public water supply.

16. No temporary camp, tent, building, or other structure for housing laborers engaged on construction work or for other purposes shall be located, placed, or maintained within a distance of five hundred (500) feet from any reservoir or watercourse tributary to the public water supply of the village of Peekskill.

Cemeteries

17. No interment of a human body shall be made within a distance of two hundred and fifty (250) feet from any reservoir or from any watercourse tributary to the public water supply of the village of Peekskill.

18. The Board of Water Commissioners of the village of Peekskill shall make regular and thorough inspections of the reservoir, streams and drainage areas tributary thereto for the purpose of ascertaining whether the above rules and regulations are being complied with; and it shall be the duty of said Board of Water Commissioners to cause copies of any rules and regulations violated to be served upon the persons violating the same with notices of such violations; and if such persons served do not immediately comply with the rules and regulations, it shall be the further duty of the Board of Water Commissioners promptly to notify the State Commissioner of Health of such violations. The Board of Water Commissioners shall report in writing annually on the 1st of January, the results of the regular inspections made during the preceding year, stating the number of inspections which have been made, the number of violations found, the number of notices served, and the general condition of the watershed at the time of the last inspection.

Penalty

19. In accordance with section 70 of chapter 45 of the Consolidated Laws (Public Health Law), the penalty for each and every violation of or noncompliance with any of these rules and regulations which relate to a permanent source or act of contamination, is hereby fixed at one hundred ($100) dollars.

The foregoing rules and regulations for the protection from contamination of the public water supply of the village of Peekskill, in Westchester county, are hereby duly made, ordained, and established on this 14th day of September, 1920, pursuant to chapter 45 of the Consolidated Laws (Public Health Law) of the State of New York, as amended by chapter 695 of the Laws of 1911.

M. NICOLL, JR.
Deputy State Commissioner of Health

ALBANY, N. Y.

These rules and regulations were published as required by law once a week for six consecutive weeks in a newspaper of Westchester county and a newspaper of Putnam county, the publication being completed November 13, 1920.

STAMFORD

Rules and regulations for the protection from contamination of the public water supply furnished by the Stamford Water

Company to the village of Stamford, Delaware county, enacted by the New York State Department of Health under chapter 49 of the Laws of 1909, constituting chapter 45 of the Consolidated Laws, as finally amended by chapter 665 of the Laws of 1915 (Public Health Law).

Rules and Regulations

The rules and regulations hereinafter given, duly made and enacted in accordance with the provisions of sections 70, 71, and 73 of chapter 45 of the Consolidated Laws (Public Health Law), as heretofore set forth, shall apply to all natural and artificial reservoirs and to all watercourses tributary thereto or ultimately discharging into said reservoir, these bodies of water being sources of the public water supply furnished by the Stamford Water Company to the village of Stamford, Delaware county, New York. The term "reservoir" wherever used in these rules is intended to mean and refer to all storage and impounding reservoirs which are tributary to or which serve as sources of this public water supply or to any additional reservoir which may be constructed or used for the purpose of this public water supply. The term "watercourse" wherever used in these rules is intended to mean and include every spring, pond (other than the artificial reservoirs and filter basins), stream, ditch, gutter, or other channel of any kind the waters of which when running whether continuously or occasionally eventually flow or may flow into the public water supply of the village of Stamford.

Wherever a linear distance of a structure or object from a reservoir or from a watercourse is mentioned in these rules, it is intended to mean the shortest horizontal distance from the nearest point of the structure or object to the highwater mark of a reservoir, or to the edge, margin, or precipitous bank forming the ordinary highwater mark of such watercourse.

Privies Adjacent to Any Reservoir or Watercourse

1. No privy, privy vault, pit, cesspool, or any other receptacle of any kind used for either the temporary storage or the permanent deposit of human excreta shall be constructed, placed, maintained, or allowed to remain within one hundred (100) feet of any reservoir or within fifty (50) feet of any watercourse tributary to the public water supply of the village of Stamford.

2. No privy, privy vault, pit, cesspool, or any other receptacle used for the permanent deposit of human excreta shall be constructed, located, placed, maintained, or allowed to remain within three hundred (300) feet of any reservoir or within one hundred (100) feet of any watercourse tributary to the public water supply of the village of Stamford.

3. No cesspool, pit, or other receptacle of any kind used for the temporary storage of human excreta or sewage shall be constructed, located, maintained, or allowed to remain between the limiting distances prescribed by rule (1) and the limiting distances prescribed by a rule (2) unless said cesspool, pit, or other receptacle is so arranged and equipped that the said excreta or sewage are at once removed by pump or other satisfactory means through watertight pipes or conduits to some proper place of ultimate disposal as hereinafter provided, or unless suitable removable vessels or receptacles for the temporary storage of said human excreta or sewage are provided and at all times maintained in an absolutely watertight condition and in such manner as to permit of convenient removal of said excreta or sewage to some place of ultimate disposal as hereinafter set forth.

4. The excreta collected in the aforesaid removable receptacles permitted under rule (3) shall be removed and the receptacles throughly cleaned and deodorized as often as may be found necessary to maintain the privy in proper sanitary condition and effectually to prevent any overflow upon the soil or upon the foundation or floor of the privy. In effecting this removal the

utmost care shall be exercised that none of the contents be allowed to escape while being transferred from the privy to the place of disposal hereinafter specified, and that the contents while being transferred from the privy to the place of disposal shall be thoroughly covered and that the least possible annoyance and inconvenience be caused to occupants of the premises and the adjacent premises.

5. Unless otherwise specially ordered or permitted by the State Department of Health, the excreta collected in the aforesaid removable receptacles permitted under rule (3) shall when removed be disposed of by burying in trenches or pits at a depth of not less than 18 inches below the surface and at a distance not less than five hundred (500) feet from any reservoir or watercourse tributary to the public water supply of the village of Stamford.

6. Whenever, owing to the character of the soil or of the surface of the ground, or owing to the height or flow of subsoil or surface water, or other special local conditions it is considered by the State Commissioner of Health that excremental matter from any privy or aforesaid receptacle, or from any trench or place of disposal, or the garbage or wastes from any dump, may be washed over the surface or through the soil in an imperfectly purified condition into any reservoir or watercourse, then the said privy or receptacle for excreta, or the trench or place of disposal, or the said garbage or waste dump, shall after due notice to the owner thereof be removed to such greater distance or to such place as shall be considered safe and proper by the State Commissioner of Health.

Sewage, House Slops, Sink Waste, etc.

7. No house slops, bath water, sewage, or other excretal matter from any water closet, privy, cesspool, or other source shall be thrown, placed, led, conducted, discharged, or allowed to escape or flow in any manner either directly or indirectly into any reservoir or any watercourse tributary to the public water supply of the village of Stamford; nor shall any such matter be thrown, placed, led, discharged or allowed to escape beneath the surface except into watertight receptacles the contents of which are to be removed, as provided by rule (4), within three hundred (300) feet of any reservoir or within one hundred (100) feet of any watercourse tributary to the public water supply of the village of Stamford.

8. No garbage, putrescible matter, kitchen or sink wastes, refuse or waste matter from any creamery, cheese factory, or laundry, nor water in which milk cans, utensils, clothing, bedding, carpets, or harness have been washed or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into any reservoir or watercourse; nor shall any such liquid or solid refuse or waste be thrown, discharged, or allowed to escape or remain upon the surface of the ground or to percolate into or through the ground below the surface in any manner whereby the same may flow into any reservoir or watercourse within a distance of one hundred (100) feet from any reservoir or within fifty (50) feet from any watercourse tributary to the public water supply of the village of Stamford.

9. No clothing, bedding, carpets, harnesses, vehicle, receptacles, utensils, nor anything that pollutes water shall be washed, rinsed, or placed in any reservoir or watercourse.

Bathing, Animals, Manure, Compost, etc.

10. No person shall be allowed to bathe in any reservoir, nor shall any animals or poultry be allowed to stand, wallow, wade, or swim in any reservoir, nor be washed therein. The watering of animals or poultry in any reservoir of the public water supply of the village of Stamford is prohibited. No watering place shall be maintained in such a way as to pollute with muddy leachings or excretal matters any streams tributary to the public water supply of the village of Stamford.

11. No stable for cattle or horses, barnyard, hog yard, pig-pen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile or compost heap, shall be constructed, placed, maintained or

allowed to remain with its nearest point less than one hundred (100) feet from any reservoir or within fifty (50) feet of any watercourse tributary to the public water supply of the village of Stamford; and none of the above named objects or sources of pollution shall be so constructed, placed, maintained, or allowed to remain where or in such a manner that the drainage, leachings or washings from the same may enter any such reservoir or watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that proper purification has been secured unless the above drainings, leachings, or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than one hundred (100) feet from any reservoir or fifty (50) feet from any watercourse tributary to the public water supply of the village of Stamford.

12. No human excreta and no compost or other matter containing human excreta shall be thrown, placed, or allowed to escape into any reservoir or watercourse, nor to be placed, piled, or spread upon the surface of the ground at any point on the watershed tributary to the public water supply of the village of Stamford, nor shall such human excreta or compost or other matter containing human excreta be dug or buried in the soil at a less depth than 18 inches below the surface nor within a distance of three hundred (300) feet from any reservoir nor within one hundred and fifty (150) feet of any watercourse tributary to the public water supply of the village of Stamford; and no manure or compost of any kind shall be placed, piled or spread upon the ground within a distance of one hundred (100) feet from any reservoir or within twenty-five (25) feet from any watercourse tributary to the public water supply of the village of Stamford.

13. No decayed or fermented fruit or vegetables, cider mill wastes, roots, grain or other vegetable refuse of any kind shall be thrown, placed, discharged, or allowed to escape or pass into any reservoir or watercourse, nor shall they be thrown, placed, piled, maintained, or allowed to remain in such places that the drainage, leachings, or washings therefrom may flow by open, blind, or covered drains or channels of any kind into any reservoir or watercourse without first having passed over or through such an extent of soil as to have been properly purified, and in no case shall it be deemed that sufficient purification has been secured unless the above mentioned drainings, leachings, or washings shall have percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of not less than seventy-five (75) feet before entering any reservoir or twenty-five (25) feet before entering any watercourse tributary to the public water supply of the village of Stamford.

Dead Animals, Offal, Manufacturing Wastes, etc.

14. No dead animals, bird, fish, or any part thereof, nor any offal or waste matter of any kind, shall be thrown, placed, discharged, or allowed to escape or to pass into any reservoir or watercourse. Nor shall any such material or refuse be so located, placed, maintained, or allowed to remain that the drainage, leachings, or washings therefrom may reach any such reservoir or watercourse without having first percolated over or through the soil in a scattered, dissipated form, and not concentrated in perceptible lines of drainage, for a distance of two hundred (200) feet from any reservoir or seventy-five (75) feet from any watercourse tributary to the public water supply of the village of Stamford.

Fishing, Boating, and Ice Cutting

15. No boating of any kind, fishing from boats, or through the ice, and no ice cutting, or any trespassing whatever shall be allowed in or upon the waters or ice of the reservoirs.

Labor Camps

16. No temporary camp, tent, building, or other structures for housing laborers engaged on construction work or for other purposes shall be located, placed, or maintained within a distance of five hundred (500) feet

from any reservoir or one hundred (100) feet from any watercourse tributary to the public water supply of the village of Stamford.

Cemeteries

17. No interment of a human body shall be made within a distance of three hundred (300) feet from any reservoir or one hundred (100) feet from any watercourse tributary to the public water supply of the village of Stamford.

Inspections

18. The Stamford Water Company shall make regular and thorough inspections of the reservoirs, streams, and drainage areas tributary thereto for the purpose of ascertaining whether the above rules and regulations are being complied with; and it shall be the duty of said Stamford Water Company to cause copies of any rules and regulations violated to be served upon the persons violating the same with notices of such violations; and if such persons served do not immediately comply with the rules and regulations, it shall be the further duty of the Stamford Water Company promptly to notify the State Commissioner of Health of such violations. The Stamford Water Company shall report in writing annually on the 1st day of January the results of the regular inspections made during the preceding year, stating the number of inspections which have been made, the number of violations found, the number of notices served, and the general condition of the watershed at the time of the last inspection.

Penalty

19. In accordance with section 70 of chapter 45 of the Consolidated Laws (Public Health Law), the penalty for each and every violation of or noncompliance with any of these rules and regulations which relate to a permanent source or act of contamination, is hereby fixed at one hundred dollars ($100).

The foregoing rules and regulations for the protection from contamination of the public water supply of the village of Stamford are hereby made, ordained, and established on this 26th day of January, 1920, pursuant to chapter 45 of the Consolidated Laws (Public Health Law) of the State of New York, as finally amended by chapter 665 of the Laws of 1915.

M. NICOLL, JR.
Deputy State Commissioner of Health

ALBANY, N. Y.

These rules and regulations were published once each week for six consecutive weeks in a newspaper in Delaware county as required by the law, and the publication completed April 21, 1920.

INSPECTION OF VIOLATIONS OF RULES FOR THE PROTECTION OF PUBLIC WATER SUPPLIES

During the year 1920 notices issued in accordance with the provisions of section 71 of the Public Health Law were received from the officer or board having by law the management and control of the water supplies of five municipalities regarding violation of the rules and regulations enacted by this Department for the protection from contamination of their water supplies which had not been abated on notices served by the local authorities on the persons violating the same. These violations were immediately investigated by representatives of the Engineering Division, and when actual violations of the rules and regulations were found by the representatives of this Division orders were issued to the local boards of health to abate the violations.

The orders issued were in connection with the water supplies of Elmira, where two violations were found; Kingston, where one violation was found; Olean, where eleven violations were found; Troy, where six violations were found; and Tarrytown, where nine violations were found.

After the orders have been issued to the local boards of health, the matter of abating the violations rests primarily with the local authorities. If a local board of health fails to secure the abatement of the violation within ten days after the receipt of the order, the corporation furnishing the water, or the municipality deriving its water supply from the waters to which the rule or regulation relates, or any person interested in the protection of the purity of the water supply, may maintain an action in a court of record for the recovery of the penalties incurred by such violation and for an injunction restraining him from the continued violation of such rule or regulation.

ANNUAL REPORTS OF LOCAL OFFICERS ON WATER RULE VIOLATIONS

In order to determine to what extent the rules and regulations for the protection from contamination of the different water supplies are being enforced and to be in a position to cooperate with the authorities in securing the abatement of violations, an order was issued by this Department in 1912 requiring an annual report on the 1st of January of each year from the local officer in charge of those water supplies for which rules and regulations had been enacted. All rules and regulations enacted since that date have included a similar requirement. These reports include the results of the inspections of the supplies by the local officials and the results of action taken toward the enforcement of the rules and regulations. In order that the reports of the different municipalities and districts may be uniform, a blank form on which to make the report is mailed to each waterworks official a few weeks prior to the date on which the report is due.

On receipt of these reports from the waterworks officials a careful study of them is made, and in cases where violations are reported the Engineering Division immediately investigates the conditions and the necessary action is taken toward the abatement of the violations.

During 1920 the officers in charge of the following water supplies reported that no violations had been found during the year or that all those found had been abated and that none existed on December 31, 1920.

Albion
Altamont
Amsterdam
Arkport
Bovina Center
Canastota
Cherry Valley
Cobleskill
Cold Spring
Corinth
Cornwall-on-Hudson
Cortland
Coxsackie
Deansboro
Delhi
Dolgeville
Fort Edward
Fredonia
Glens Falls
Hamilton College
Haverstraw
Highland Mills and Central Valley
Hornell
Hudson
Ilion
Kingston
LeRoy
Little Falls
Lyons
Mechanicville
Middleburg
Middletown
Middleville
Monticello
Morris
Newburgh
New Paltz
New Rochelle
North Tarrytown
Norwich
Olean
Oneonta
Ossining
Peekskill

Penn Yan
Philmont
Port Jervis
Pulaski
Rochester
Saranac Lake
Saratoga Springs
Saugerties
Sherburne
Sylvan Beach
Syracuse
Syracuse Suburban Water Co.
Warwick
Waverly
Wellsville
West Carthage
Westfield
Woodridge

The officers in charge of the following cities report one or more violations existing at the end of the year. In most of these cases the violations have been verified by this Department and orders issued to the local boards of health to abate them. A few which were first reported to this Department in the annual report of the local officers for the year 1920 will be investigated by the Engineering Division during the early part of 1921.

Auburn
Avon and Geneseo
Elmira Reformatory
Gilbertsville
Cornell University
Mount Vernon
Nyack
Tarrytown
Troy
Utica
Yonkers

No reports were received from the following places, although blank forms were forwarded to them and letters sent later calling the attention of the authorities to the necessity of making an annual report.

Chester
Elmira
Ithaca
Perry
Suffern
Walton

WATER SUPPLIES USED FOR DRINKING AND CULINARY PURPOSES BY COMMON CARRIERS ENGAGED IN INTERSTATE TRAFFIC

Section 13 of the Interstate Quarantine Regulations promulgated by the Treasury Department on January 13, 1916, in accordance with the act of Congress approved February 15, 1893, requires that water provided for drinking or culinary purposes on any car, vessel, or other conveyance while engaged in interstate traffic shall be from a source which is certified and approved as producing water of satisfactory sanitary quality and safety, this certificate to be based on the relative freedom of the water from contamination, or exposure to contamination, as determined through a survey of the sanitary conditions under which the supply is produced and the results of bacteriological and chemical analyses of samples of the water. The certificates may be issued by officers of the United States Public Health Service or the State Department of Health having jurisdiction.

In the case of water supplies in the State of New York, as the result of an arrangement made during the year 1920, the Engineering Division of this Department inspects the supplies once a year if the available force of the Division makes it possible. Samples of the water are collected at the time of the inspection by the engineer making it, and at other times when possible or necessary by representatives of this Department for analysis by the Division of Laboratories and Research. Based on the results of the inspection and the analyses of samples of water, the Engineering Division prepares data sheets showing briefly the condition of the supply and the results of the analyses of the samples of the water. These sheets, together with reports on the inspection of the supply giving in detail its character and condition, are forwarded to the United States Public Health Service as soon as possible after the inspection and analyses have been made. On receipt of this data the United States Public Health Service issues a certificate to the railroad or other carrier permitting, temporarily permitting, or not permitting, the use of the water for drinking or culinary purposes in interstate traffic.

There are, according to the information furnished by the United States Public Health Service and the railroads, 94 different water supplies in the State of New York from which water is taken for drinking and culinary purposes in interstate traffic.

Name	Railroad
Albany	B. & A.; N. Y. C.
Auburn	N. Y. C.; Leh. Val.
Beacon	Central New England
Binghamton	D. & H.; D., L. & W.; Erie
Blossburg	Erie
Buffalo	N. Y. C.; D., L. & W.; Lehigh; Penn; N. Y. C. & St. L.; Wabash
Buffalo Creek	B., R. & P.
Cadosia	N. Y., Ont. & West.
Canandaigua	Penn.
Chatham	B. & A.; N. Y. C.; Rutland
Cherry Valley	D. & H.
Clinton	N. Y., Ont. & West.
Colonie	D. & H.
Cooperstown	D. & H.
Corning	N. Y. C.; Erie
Cortland	Lehigh Valley
Delanson	D. & H.
Delhi	N. Y., Ont. & West.
Dolgeville	N. Y. C.
Deposit	Erie
East Buffalo	D., L. & W.
East Salamanca	B., R. & P.
Edmeston	N. Y., Ont. & West.
Elmira	D., L. & W.; Erie; Penn.
Fulton Chain (see Thendara)	
Grand Central Terminal	N. Y., N. H. & Hart.
Hammondsport	Erie
Herkimer	N. Y. C.
Harlem River	N. Y., N. H. & Hart.
High Bridge	N. Y. C.
Hornell	Erie
Hudson	B. & A.; Uls. & Del.
Hunter	Ulster & Del.
Ithaca	D., L. & W.
Jamestown	Erie
Kaaterskill	Ulster & Del.
Kingston	N. Y. C.; U. & D.; N. Y., Ont. & West.
Lake George	D. & H.
Liberty	N. Y., Ont. & West.
Lincoln Park	B., R. & P.
Livingston Manor	N. Y., Ont. & West.
Long Island City	L. I. R. R.; Penn.
Malone	N. Y. C.; Rut.
Middletown	N. Y., Ont. & W.; Erie
Millerton	Cen. New England
Monticello	N. Y., Ont. & West.
Mott Haven	N. Y. C.
Newburgh	Erie; N. Y. C.
New Rochelle	N. Y., N. H. & Hart.
New York City	Erie; N. Y. C.; C. R. R. N. J.; Penn.; N. Y., N. H. & Hart.; Lehigh Val.

Name	Railroad
Niagara Falls (West. N. Y. Water Co.)	N. Y. C.
North Creek	D. & H.
Norwich	N. Y., Ont. & West.
Nunda	Penn.
Ogdensburg	Rutland
Olean	Penn.
Oneida	N. Y., Ont. & West.
Oneonta	D. & H.
Oswego	D., L. & W.; N. Y., Ont. & West.
Peekskill	N. Y. C.
Perry	B., R. & P.
Phoenicia	Ulster & Del.
Plattsburg	D. & H.
Port Chester	N. Y., N. H. & Hart.
Port Jervis	N. Y., Ont. & West.; Erie
Poughkeepsie	Cent. New Eng.; N. Y. C.
Raquette Lake	N. Y. C.
Ravena and Coeymans	N. Y. C.
Rensselaer	B. & A.; N. Y. C.
Richfield Springs	D., L. & W.
Richmond Hill	L. I. R. R.
Rochester	Erie; N. Y. C.; Penn.; B., R. & P.
Roscoe	N. Y., Ont. & West.
Rouses Point	D. & H.
Salamanca	Erie
Saranac Lake	N. Y. C.
Saratoga Springs	B. & M.; D. & H.
Schenectady	D. & H.; N. Y. C.
Schuylerville	B. & M.
Sidney	N. Y., Ont. & West.
Summitville	N. Y., Ont. & West.
Sodus Point	Penn.
Syracuse	D., L. & W.; N. Y. C.
Thendara (Fulton Chain)	N. Y. C.
Ticonderoga	D. & H.
Troy	B. & M.; N. Y. C.
Tupper Lake Junction	N Y. C.
Utica	D. L. & W.; N. Y. C.; N. Y., Ont. & West.; B. & A.
Valley Junction	N. Y., Ont. & West.
Walton	N. Y., Ont. & West.
Warwick	Lehigh & Hudson
Wayland	D., L. & W.
Whitehall	D. & H.

The inspection of these supplies was taken up during the latter part of the year in connection with the regular work of inspections of the water supplies of the State and information regarding 25 supplies furnished to the United States Public Health Service, on the receipt of which certificates were issued to the common carriers using the water from these supplies. The data furnished to the United States Public Health Service in connection with the inspection of these supplies and the character of the certificate issued by the United States Public Health Service are mentioned under the name of the supplies in a section of this report on the investigation of the public water supplies.

INVESTIGATIONS OF PUBLIC WATER SUPPLIES

There are at the present time, so far as is known, 543 public water supplies in the State of New York, the sanitary condition of all of which has been investigated by the Engineering Division of this Department. During 1920, 190 of these water supplies were inspected, either on account of some change or insanitary condition, at the request of the local authorities or voluntarily as a part of the routine work of the Division, inspections of as many supplies being made during the year as is possible with the limited force available. The investigations include a careful inspection, the collection and analyses of samples of the water, and the preparation of reports giving all the essential information relative to the supply and a summary of the results of the investigations, together with recommendations for such improvements as may be deemed necessary or advisable. Copies of these reports are transmitted to the local authorities in charge of the water works, to the local health officer, to the sanitary supervisor of the district, and where the water is used by common carriers engaged in interstate traffic, to the Surgeon-General of the United States Public Health Service.

Samples of water from the supplies are taken in connection with all inspections, but in order to avoid duplication only the results of those which are necessary to an understanding of the conditions are included in the description of the supplies given below. The full analyses may be found in the report of the Division of Laboratories and Research. Where given, the results of the chemical analyses are in parts per million.

AKRON

A reinspection of the public water supply of the village of Akron was made by Mr. Earl Devendorf, assistant engineer in this Department, on September 29, 1920. A previous inspection of this supply was made by the Department in 1916 and the report thereon printed in the Annual Report of the Department for that year.

Akron is an incorporated village of about 1,800 inhabitants located in the northeastern part of Erie county on the West Shore Railroad, about 20 miles east of Buffalo. Nearly all of the inhabitants in the village are supplied with the public water supply. While there are a few private sewers which discharge without purification in the creek, most of the houses are served by cesspools and privies.

The public water supply is derived from a dug well located in the western part of the village. The consumption is said to vary from 300,000 to 400,000 gallons per day. The well consists of a covered basin some 25 feet by 50 feet in plan. It was formerly only 8 feet in depth but the depth has recently increased to 20 feet. The bottom of the well is limestone rock and the sides of the well are constructed of concrete walls. At the time of the inspection there was about 10 feet of water in the well. It is stated, however, that the depth is sometimes as great as 15 feet. The water is said to enter from 2 or 3 fissures in the rock near the bottom. From the well the water is pumped through the distribution system into a steel standpipe 15 feet in diameter and 75 feet high, having a capacity of 100,000 gallons, and located in the eastern part of the village about a mile from the pumping station.

The village proper is higher in elevation than the ground where the well and pumping station are located and the general slope of the village is toward the well. Near the pumping station a privy is located within 50 feet of the well and at an elevation of some 15 feet above the well. There are some 15 people living within 100 feet of the well and approximately 200 within 1,000 feet of the well. The village is located in a limestone region and the depth of soil covering is relatively shallow. Since there are numerous fissures to be found in all limestone regions, it is apparent that pollution from the cesspools and privies from practically the whole of the village may find its way into the ground water supply of the well used as a source of public water supply. The engineer was informed that under certain storm conditions the water in the well is quite turbid, indicating that the water under such conditions receives little if any natural purification by filtration through the soil. Under such conditions it is very apparent that the supply cannot be considered entirely safe, even with the present method of sterilization by means of liquid chlorine, since the rate of application is not varied with the character of the water being pumped.

The results of the bacteriological examination of samples of the chlorinated supply taken at the time of the inspection show high total counts probably the results of multiplication of various forms of water bacteria due to the delay in transit. Organisms of the B. coli type were present in all of the 10 c.c. and one of the 1 c.c. inoculations examined, indicating that the amount of chlorine being applied to the water was not sufficient for the effective sterilization of the public water supply.

As a result of the inspection it was concluded that the well from which the public water supply of the village of Akron is derived is unsatisfactorily located, due to the fact that the ground water sources are subject to pollution from practically the entire village population and receive little natural purification by passing through the soil; that due to the excessive hardness of the water the supply is not satisfactory for laundry or commercial purposes; and that the chlorination apparatus is not being operated in such a manner as effectively to sterilize the public water supply at the time the samples were collected.

It was therefore recommended that the village authorities in charge of the public water supply secure the services of a competent water supply expert to make a study of the possible sources of water supply and the treatment of the present supply, and advise them as to the best method of securing a satisfactory supply; and that until such a satisfactory supply is obtained the present supply be effectively sterilized by means of liquid chlorine, and that to accomplish this the present rate of application of chlorine be increased and regulated in accordance with the result of frequent tests for for excess chlorine and such bacterial examinations as may be made from time to time.

ALBANY

The public water supply of the city of Albany was investigated by Mr. Theodore Horton, chief engineer in this Department, and Mr. E. S. Chase, assistant engineer, during March, 1920. A special investigation of the water supply was also made by Mr. Horton in connection with the outbreak of colitis in the city of Albany during the latter part of February, 1920. The complete reports on both of these investigations follow.

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

In accordance with your request I beg to submit the following report with reference to the recent outbreak of colitis in the city of Albany, of my inquiry into it with reference to the public water supply, and of the advice given the city in order to correct the trouble.

My first information regarding any prevalence of colitis in the city was on or about February 26, just before I was leaving for New York city on a special investigation, when through indirect channels I had learned of a number of persons who had been affected with this malady. Before leaving the city, however, I called up Mr. George E. Willcomb, chief chemist in charge of the filter plant, and upon inquiry learned that he also had indirectly heard of similar cases. At this time, owing largely to the fact that colitis is not a reportable disease, neither Mr. Willcomb nor the writer had received officially or indirectly any definite knowledge as to the exact nature and prevalence of the malady or as to its probable or alleged source. Upon inquiry into the operation of the filter plant, I learned, however, that the plant was then being run as it had been for a considerable period of time, and as has been customary at certain seasons, without the use of alum as a coagulant. The water at this season of the year usually carries an excess of organic matter, with low turbidity, and owing to the diminished efficiency of filtration in the absence of coagulation due to these extremes it has been necessary to apply chlorine in corresponding additional amounts in order to obtain a water of safe bacteriological quality.

It should be particularly borne in mind that up to this time there had been presented no specific evidence indicating that the water supply was primarily or indirectly the cause of the colitis. On the contrary, there seemed to be a general grippe or intestinal flu. From a hasty review of what facts I was able to obtain, it was at once clear to me that the trouble might be due to the water supply. I explained this to Mr. Willcomb and called his attention to the fact that elsewhere in the State under similar conditions, as in the case of Green Island recently, the water supply had been found to be responsible for colitis, notwithstanding the fact that the bacterial quality of the water had been within acceptable analytical standards; and that in my judgment, and notwithstanding that other causes had been assigned, the real cause of this outbreak of colitis was to be found in either the physical or the sanitary quality of the water. I therefore inquired whether it would not be possible to resume alum treatment as a precautionary measure and irrespective of the question of what the real cause of the trouble might be.

It was explained to me, however, that only a limited amount of alum was on hand, due to delayed shipment of this material resulting from the serious congestion of the railroads and embargoes of freight material. With only a limited supply of alum on hand, and the certainty of flood conditions in the river at an early date, at which time the use of alum would be imperative, the situation was obviously one of serious moment, and Mr. Willcomb hesitated acting immediately upon my recommendation, at least until more definite information was presented that the trouble was water-borne. I was assured, however, that the matter of resuming the application of alum in the coagulation basin would be taken up at once and efforts made to hasten alum shipments which had been ordered.

On Tuesday, March 2, upon my return from New York, I again communicated with Mr. Willcomb and inquired into the situation with reference to any further spread of colitis in the city, as to the results of his endeavors to hasten shipments of alum, and as to the condition of the water generally. I was advised that no trace of the shipments of alum had been obtained, although efforts were being continued to trace them; that further and more definite information had been received concerning the presence of colitis in the city; that he was experiencing some difficulty in keeping the bacterial quality of the water up to a satisfactory standard owing to the excess of organic matter and low turbidity; and that a considerable excess of chlorine was still being constantly applied in an effort to keep the bacterial quality within satisfactory limits. Mr. Willcomb stated, however, that there was still no definite or convincing evidence that the colitis was due to the water, and that opinions were still held among physicians that the colitis was attributable to other causes and not to the water supply.

The matter was discussed quite at length with Mr. Willcomb on this occasion, when I pointed out that the situation, epidemiologically, was very characteristic, was analogous to what has occurred in other municipalities having waters of a similar character, and although there was little probability that typhoid fever in any appreciable amount would follow, the physical condition alone of the water, with its excessive organic matter and excess of chlorine, and irrespective of its bacteriological quality, was in my judgment such as to readily account for the colitis. It was also obvious to me that the only logical thing to do was to resume alum treatment at once, which would readily prove whether or not the condition of the water was the source of the colitis, and in the meantime remove the cause of the trouble if due to the water supply. With reference to the limited supply of alum on hand, and the possibility of a shortage due to flood conditions, I figured from the information given me that there was ample supply on hand to justify the immediate use of alum for at least a limited period, during which time every effort could be made to locate and have delivered the shipments of alum which had been ordered.

Following this interview with Mr. Willcomb, and another one later with Mr. Greenalch, Commissioner of Public Works, concerning the situation, it was decided on March 5 to resume the application of alum. Since then the situation has apparently cleared up, and so far as it has been possible for us to obtain the information through inquiries made of physicians in the city (this disease not being reportable), only a few, if any, new cases of colitis have occurred subsequent to March 5, the date of resumption of alum treatment. At the same time, the organic matter in the water furnished has been largely eliminated, the amount of chlorine necessary for proper sterilization greatly reduced, and the bacterial quality of the water greatly improved. No cases of typhoid fever have as yet been reported, and although it may be too early to make any definite statement in this regard, there is certainly little evidence to indicate that any undue prevalence of this disease will occur.

In conclusion, I would state that the evidence presented in connection with this outbreak of colitis demonstrates clearly that the water supply was the causative and responsible factor; and that it is obvious, if similar outbreaks are to be avoided in the future, that the city should adopt continuously and uninterruptedly the alum treatment in the operation of its filtration plant, and that satisfactory provision should be made with reference to storage and shipments of alum to insure that an adequate supply of this chemical be always on hand.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *March* 12, 1920

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report upon the public water supply of the City of Albany, based upon an investigation made by the writer and Assistant Engineer, E. S. Chase, during March of the present year.

Albany, the capital of the State, is situated on the right bank of the Hudson river some 150 miles above its mouth and a short distance below the head of navigation. With a population according to the recent census of 114,000, it comprises, with other nearby municipalities, an urban district of approximately one-quarter million people. It is an important railroad center, with lines of the New York Central, Boston and Albany, Boston and Maine, Delaware and Hudson, and West Shore railroads making connections with the principal centers of population in northeastern United States. River transportation, both passenger and freight, is provided by the Hudson Navigation

Company and by the Hudson River Day Line. A comprehensive system of sewers on a combined plan carries domestic and storm water sewage to a disposal plant located on Westerlo Island, south of the city, consisting of grit chamber, pumping station, and Imhoff tanks.

The public water supply is owned by the city and operated under the direction of Wallace Greenalch, Commissioner of Public Works. The principal source of supply, representing about 85 per cent of the total, is obtained from the Hudson river, the intake being located about 2 miles north of the center of the city. This supply is obtained from the Hudson river, and is subjected to filtration and chlorination and thence pumped into the distribution system. A second source of supply is obtained from Rensselaer lake, an artificial body of water located some few miles west of the city, the water from which, unpurified, is led through a pipe line to Bleecker reservoir, situated in the city just east of Swinburne park, from which it is distributed by gravity into the present city mains. A third source of supply is obtained from Patroons and Sands creek in the northwestern part of the city, which, partially purified, is distributed by gravity to the West Albany railroad shops of the New York Central railroad. A fourth and comparatively small source of supply is derived from Maeslandt kill, a small stream lying north of the city, which, unpurified, serves a few houses on North street and the filtration plant.

History and Development of Supplies

The public water supply of Albany was originally developed by the Albany Water Works Company which operated the system between the years 1802 and 1851. This original supply was obtained by gravity from the two small upland streams, Patroons creek and Maeslandt kill, lying a short distance north of the city. The first distribution system consisted of bored wooden logs, one of the oldest types of water mains used in the country. Later, iron pipes, cast in two and three-foot lengths, were used to some extent. In the earlier days the water was led through pipe lines to the city and stored in cisterns constructed beneath the streets, but in 1811 a distributing reservoir was built at the corner of Eagle and Columbia streets, the site of the present county building.

In 1851 the waterworks were purchased by the city and the original sources of supply continued in use. In 1852 the Rensselaer Lake and Bleecker reservoirs, with connecting conduit, were constructed. These upland supplies served the city exclusively until 1873. During this interval, however, numerous complaints were made of the objectionable tastes and odors in the water, and at times regarding its insufficiency. It therefore became necessary to provide an increased supply, and after consideration of a number of possible sources suggested by different engineers and sanitarians it was finally decided to adopt the Hudson river as a source of increased supply. This decision brought about the construction in 1873 of a pumping station and an intake in the Hudson river at the foot of Quackenbush street. The river water obtained through the new intake was at first pumped directly into the Bleecker reservoir. Later, in 1876, Prospect reservoir was constructed to provide a high service supply, the water being pumped from the Bleecker reservoir into the Prospect reservoir.

Soon after the Hudson river supply was introduced into the city in 1873, the question of its sanitary quality arose. Complaints still continued regarding tastes and odors, and its purity from the standpoint of health frequently arose. Furthermore, the growth of the city and the water consumption had increased materially, and necessity for additional relief reached a climax in 1884 and 1885. During the latter year a special water commission was created to inquire into available sources for a pure supply for the city, and if they deemed the present supply the most available, then as to what method, if any, could be adopted for purification. This commission recommended in 1885, and the common council of the city approved, a contract for the construction of a system of wells by W. P. Andrews Bros. These wells were to be located either on the sand plains west of the city or on the river flats along the Hudson. In an attempt to fulfill this contract, some 390 tubular wells were sunk near the Hudson in the lowlands immediately north of the present filtration plant. A yield of some 6,000,000 gallons daily was claimed for these wells, but the test called for in the contract was apparently never carried out and the wells were not accepted by the city. The exact reason why these wells were abandoned or were not accepted is not clear, but it appears probable that it was due to either questionable yield or unsatisfactory quality of the water, or both.

In addition to this proposed well supply, the special water supply commission also investigated and reported upon the possibility of securing a supply from two other sources, namely, the Normanskill at French's Mills, some 11 miles west of the city; and Kinderhook creek on the east side of the Hudson, some 15 miles from the city. Neither of these projects, however, was adopted by the city although both were favorably reported upon by prominent consulting engineers, the former by Rudolph Hering and John Bogart, and the latter by Frederick P. Stearns and Clemens Herschel.

Although the city did not adopt any of the plans for a new supply, it did however in 1888 abandon the original intake on the Patroons creek supply situated below the West Albany railroad shops, and constructed a new distribution reservoir known as the Tivoli reservoir, situated on higher ground in the vicinity of the old intake, this reservoir receiving water through pipe lines from two other reservoirs constructed at the same time, one on Patroons creek just above Russell road and the other on Sands creek just above the same road. Later, in 1895, the city also constructed a new pipe line from the Quackenbush pumping station to the Prospect reservoir, and abandoned the Prospect pumping station. These improvements, while affording relief principally in regard to increased capacity, did not afford relief so far as the quality of the Hudson river supply was concerned.

The city continued to suffer from an excessive death rate from typhoid fever as a result of impure quality of the Hudson river supply, and in 1897 another prominent consulting engineer, Allen Hazen, was retained to investigate and report upon the feasibility of filtering the Hudson river. Mr. Hazen's report recommended the installation of slow sand filters for the purification of Hudson river water. This recommendation was adopted although considerable opposition had developed in favor of the installation of rapid sand filters. Construction work on the new filtration plant was begun in 1898. This plant comprised a new intake located about two miles north of the city, a sedimentation basin, slow sand filters, clear water basin, and a four-foot pure water conduit leading from the purification plant to the Quackenbush pumping station. The works were completed and first put in continuous operation on September 6, 1899.

A few years later it became necessary to increase the capacity of the filtration plant and to provide improved facilities for caring for the increased water consumption, and for meeting difficulties of operating filters of the slow sand type. Accordingly, in 1907, a new intake was constructed at the filter plant by extending the old intake out into the main channel of the Hudson river, and in 1908 the present preliminary filters were completed and first put into service. Sterilization of the supply with hypochlorite of lime was first introduced in 1909, and in 1916 this treatment was supplemented by sterilization with liquid chlorine. In 1910 the Tivoli distribution reservoir was abandoned, and with the exception of a short period in 1917 has not since been used.

Detailed Description of Waterworks

(a) Hudson River System:

Distribution System, High and Low Service: The present distribution system consists of about 165 miles of castiron water mains ranging in size from 3 to 36-inches in diameter. There are two independent service systems, the high service which is connected with the Prospect reservoir, and the low service connected with the Bleecker reservoir. The boundary between the two systems runs approximately north and south along Swan street. The average daily water consumption at the present time is about 24,000,000 gallons, of which 1,500,000 gallons are obtained from Rensselaer lake supply through the Bleecker reservoir and the low service system. Approximately 2,000,000 gallons a day additional is obtained from the old Sands creek and Patroons creek supplies and delivered to the West Albany shops of the New York Central railroad. The Maeslandt kill supply serves independently only a few houses and the filtration plant. There are approximately 18,000 service taps, of which about 46 per cent are metered.

Pumping Stations: The pumping station at the purification plant is a substantial brick and concrete structure. This station contains seven steam driven centrifugal pumps, as follows: One 16,000,000-gallon raw water pump; two 14,000,00-gallon raw water pumps; two 30,000,000-gallon settled water pumps; and two 10,000,000-gallon wash water pumps. A 1,500,000-gallon direct acting pump is used for washing and conveying filter sand. The raw and settled water pumps are driven by vertical compound condensing engines, while the wash water pumps are driven by vertical double simple engines. Steam is furnished by three 250-h. p. water tube boilers.

The main pumping station at Quackenbush street contains five vertical triple expansion fly-wheel pumping engines, three of 5,000,000 gallons and two of 10,000,000 gallons daily capacity. The piping arrangement permits the pumping of water independently into either high or low services. Steam is furnished by four 300-horsepower water tube boilers.

Prospect and Bleecker Reservoirs: The water from the main pumping station is pumped independently into the two distribution service systems connected with the two reservoirs, Prospect and Bleecker, against the pressure maintained by each reservoir. Both reservoirs are of masonry construction surrounded by earthen embankments and uncovered. The Prospect reservoir has a capacity of 7,300,000 gallons and the Bleecker reservoir a capacity of 32,000,000 gallons. The Prospect reservoir, which is connected with the high service system, receives filtered river water only, while the Bleecker reservoir receives a mixture of unpurified Rensselaer lake water and filtered river water.

Hudson River Intake: The intake from the Hudson is located at the Government dike on the west bank of the main channel of the river. This intake consists of a monolithic concrete structure with four vertical inlet ports 4 by 6 feet in area and protected by iron bars placed 8 inches center to center. After passing through the inlet ports the water flows through stilling devices into a concrete conduit 5 feet in diameter and 1,035 feet in length discharging into the pump well of the low-lift pumps at the pumping station. The invert on this conduit is 8 feet below mean low water.

Sedimentation Basin: From the suction well the raw water is pumped against a head of about 18 feet into the sedimentation basin. This basin is 383 by 600 feet in area by 9 feet in depth and has a capacity of 14,600,000 gallons. The raw water enters the basin at the southeast corner, and the effluent flows through an outlet at the northwest corner to pumps which discharge upon the preliminary filters. No baffles are provided in this basin so that its full detention capacity is not utilized, the actual detention period being estimated at about 12 hours. The cleaning of the basin occurs every year or two, and is accomplished by draining off the water and flushing the deposited solids through a mud pipe the entrance to which is located near the middle of the basin. Hydrants are located around the perimeter of the basin for this purpose.

Chemical Mixing Devices: At certain periods of the year, particularly during flood conditions, alum is applied to the raw water before it passes to the sedimentation basin by means of injectors placed at the discharge end of the raw water pumps. The alum is mixed in a dissolving tank in which the temperature is raised by steam to nearly boiling. From this dissolving tank the alum solution is run into two 5,000 gallon solution tanks and the solution made up to a strength of approximately 8 per cent. Mixing is accomplished by means of air agitation. From these tanks the alum solution flows by gravity through a constant level orifice box and thence to a line leading to the raw water pumps. The alum is applied in amounts ranging from 1 to 3 grains per gallon, depending upon the turbidity and organic constituents in the raw water. The minimum amount is applied immediately after floods in the river, and the maximum in the late summer when the organic content of the river water is at its highest. The dose to be applied is determined by bottle tests.

Preliminary Filters: After sedimentation the water is pumped upon the preliminary filters, which are sixteen in number. These filters consist of concrete tanks having an area of 810 square feet each, or a total area of about 0.3 acres. A continuous concrete roof covers all these filters and an operating gallery extends along the front. The sand bed is 30 inches in depth and overlies 18 inches of gravel. The effective size of the sand is 1.5 millimeters, and the uniformity coefficient is 3.0. The gravel layers range in size from 3 inches to ⅛ inch. The strainers are vertical brass tubes extending about 4 inches above the floor, and in each of these tubes near its top are eight ⅛-inch holes. These strainers are spaced 9 inches center to center, and there are 1780 in each bed. The strainers are connected with a collecting system of concrete pipe which leads into the main effluent channel, 24 inches in diameter, which in turn leads into a float well and control chamber. The filtered water flows from this control chamber over a weir into a conduit leading to the slow sand filters.

The preliminary filters are ordinarily operated at a rate of 70,000,000 gallons per acre per day. The filter runs average about 30 hours, but at times may be as small as 8 hours only. The filters are washed by reverse flow in the usual manner, the amount of wash water approximating 3 per cent of the total amount of water filtered. About once every two years the sand in the filters is removed, washed in Nichols sand-washers, and replaced. The water level over the filtered sand is maintained at a depth of about 3 feet by regulating the discharge of the pumps upon the beds. The wash water troughs are of concrete, 2 feet wide with 4-inch sides, and are approximately 12 inches above the top of the sand. During washing the vertical rise of the wash water is 1.3 feet per minute. The filters are washed until the wash water runs fairly clear. No water is filtered to waste after washing. The valves are hydraulically operated. The rate controller of each filter consists of a valve operated by a float in the control chamber and may be adjusted by changing the position of the float upon the spindle leading from the valve.

Slow Sand or Secondary Filters: The slow sand, or secondary filters, are eight in number, each 0.7 acres in area, thus giving a total filtering area of 5.6 acres. The filter basins are constructed of concrete and brick and covered by vaulted concrete roofs over which two feet of earth and sod is placed to protect the filters from freezing. The sand in the filters has a maximum depth of 4 feet over about 12 inches of graded gravel. The sand has an effective size of 0.32 millimeters, and a uniformity coefficient of 2.0. The gravel ranges from ¾ of an inch to ⅛-inch material. The sand was originally obtained by dredging from the river. The effluent from the preliminary filters enters each bed at one corner through a baffled control well in which are placed 20-inch gate valves, operated by hand. An attempt to secure automatic control was made by the installation of float valves, but in the case of only one of the filters have these valves proved successful. The underdrains consist of 6-inch tile pipe laid with open joints, which discharge into a 30-inch main drain of vitrified tile surrounded by concrete. From the main drain the clear water flows through outlet wells in which are calibrated submerged orifices through which the rate of flow is measured by means of float operated indicators. The normal depth to which water is carried over the filter sand is 5.5 feet, and the average rate of operation of the filters is about 2,500,000 gallons per acre per day. When the loss of head reaches about 4 feet the filters are cleaned by scraping off about 1 inch of the top layer of sand and ejecting it outside of the filters. The average length of run between the scrapings is about 60 days. The sand is removed from the filters until a minimum thickness of sand of about 24 inches remains. The dirty sand removed from the filters is then washed in a Nichols' sand-washing machine and ejected back upon the bed. The entire sand of the filters is replaced about once every eight years. After scraping, a filter is refilled by the effluent of the adjacent bed and is then run for a while at a low rate of filtration.

In 1914 it became impossible to pass all the effluent of the primary filters through the secondary filters owing to the heavy draft upon the supply and to the clogged condition of the filter beds. At this time by-passes were constructed from the top of the last two sand filters in order to divert primary effluent into the clear water basin. Since that year it has been customary to by-pass varying amounts of primary effluent into the clear water basin in amounts ranging from nothing in April, May, and June, to 60 per cent at such times of the year as the high organic matter in the river water renders operation of the slow sand filters difficult.

Sterilization Plants: Sterilization of the filter effluents is provided as they enter the clear water basin. Two types of apparatus are employed, the original hypochlorite plant being used at times, and at other times the more recently installed liquid chlorine apparatus. Whichever apparatus is in use, the other is always held in readiness for emergency.

The hypochlorite plant consists of a 4-foot by 4-foot circular iron tank in which the bleach is first mixed and screened. From this tank the concentrated solution is drawn into two circular concrete tanks 21 by 4 feet deep and made up to the requisite strength. From these tanks the solution is withdrawn from the top by means of a flowing orifice. This orifice is connected by means of a glass tube with flexible joints to a 2-gallon Wolff bottle in which the air is compressed in direct proportion to the head of solution in the tanks. A special vulcanized valve on the feed tank of the Wolff bottle provides a means of regulating the pressure of air in the bottle which is shown by a small manometer tube of mercury. In the neck of the bottle is a collar in which vulcanized orifices of various sizes may be inserted in order that the rate of application may be varied as desired.

The liquid chlorine equipment consists of three manual control manometer type solution feed apparatuses manufactured by the Wallace and Tiernan Company. Twelve 150-lb. chlorine cylinders are attached to each apparatus, these cylinders being placed on large platform scales in order that the readings of the apparatus may be checked by actual weighing.

In the case of the hypochlorite solution, its actual strength is determined by analyses and the strictest control over its application. For several months past it has been the practice to maintain an excess of chlorine in the treated water ranging from 0.01 to 0.15 p.p.m. by weight as determined by the orthotolidin method. The chlorine solution is applied in the clear well at such a point as permits the thorough mixing of the chlorine solution with the filter effluent. The amount of chlorine applied varies from about 0.2 to 1.5 p.p.m., depending upon the amount of organic matter present in the water.

Clear Water Basin and Conduit: The clear water basin is 94 feet square, with a capacity of 600,000 gallons, and is covered by a concrete roof. From this basin a 4-foot steel conduit, certain sections of which are surrounded by concrete, extends for 7,913 feet to the Quackenbush pumping station. This conduit is laid for a considerable portion of its length in the bed of the old Erie canal. It has only a comparatively shallow covering of from 2 to 5 feet, and flowing substantially by gravity is under practically no head or pressure. This line has been in service for some twenty years, and an inspection made some seven or eight years ago indicated that considerable deterioration had taken place which, of course, has since increased.

(b) Rensselaer Lake Supply:

Rensselaer Lake, from which the upland supply is obtained, is formed by an earthen and masonry dam across the course of a small stream a short distance west of the city. The watershed tributary to this reservoir is but 2.75 square miles in area and at certain times of the year the supply in the reservoir is depleted. The water from this source, however, is used almost constantly throughout the year, yielding on the average about 1,500,000 gallons per day.

The watershed is a sparsely inhabited sandy plain covered with growths of scrub timber. There are only five or six houses on this area, and consequently opportunities for serious pollution from a resident population are not numerous although there is ever present the possibility or chance of wilful pollution from visitors or other persons who have access to the watershed. Perhaps the most unsatisfactory feature in connection with the sanitary quality of this supply is the fact that the main line of the New York Cental railroad crosses the reservoir, thus affording opportunity for direct contamination of the railroad embankment and the reservoir itself through the use of toilets on passenger trains. Trouble has also been experienced in this reservoir due to algae growths, although such growths have been fairly satisfactorily controlled by the judicious use of copper sulphate. From the standpoint of both physical and sanitary quality the supply can not be considered satisfactory without purification, and in view of its comparatively small yield and difficulty and expense of independent purification, it will probabply prove more practical and economical to abandon the supply entirely at an early date.

(c) Patroons Creek and Sands Creek Supply:

The Patroons creek and Sands creek, which supply the West Albany shops of the New York Central railroad, have watersheds of 5.5 and 3.0 square miles respectively. Both of these watersheds are comparatively thickly populated, and the streams are consequently somewhat seriously contaminated. The water from these streams was formerly distributed through the Tivoli reservoir to a certain section of the lower part of the city. This reservoir, however, was abandoned in 1910, and this supply is now used exclusively by the New York Central railroad. The water used for railroad purposes is approximately 2,000,000 gallons daily. The Sands creek water is used at the round house, and the Patroons creek supply at the car shops.

A special investigation of the water supply of the West Albany shops was made by an engineer in this Division in November, 1919. Although these supplies are used mainly for industrial purposes, a portion however is used for drinking purposes at the car shops after purification by means of a small pressure filter. Between the shop distribution system and a line from the Prospect reservoir there is a cross connection which is said to be equipped with double check valves to prevent the railroad supply being pumped back into the reservoir. The double check valves were installed some years ago after creek water had been pumped back into the reservoir. Both of these supplies, owing to their unsatisfactory sanitary quality and the fact that they do not now receive adequate or efficient purification, should be effectively purified before use, or as with the case of the Rensselaer Lake supply, be permanently abandoned at an early date.

(d) Maeslandt Kill Supply:

The Maeslandt Kill supply, which has been developed by a small intake constructed across the stream about 1½ miles northwest of the purification plant. This supply furnishes water by gravity to a few houses on North street and to the filter plant. At the filter plant this water is used to operate various hydraulic water pumps in the laboratory, and for sand ejecting and washing. Above the intake the watershed has an area of approximately 1 square mile upon which are about 20 houses. Although the majority of these houses are fairly remote from the stream, there is, of course, ample opportunity for its contamination from accidental and incidental sources and from surface wash. The supply is relatively unimportant, is of questionable quality, and owing to the doubtful practicability and economy of developing it satisfactorily for domestic use, should be also abandoned or at least discontinued for drinking and other domestic purposes.

Sanitary Quality of Hudson River Water

The watershed of the Hudson river above the waterworks intake is approximately 8,270 square miles. Upon this area are situated a considerable number of cities and villages and many industries which discharge sewage and wastes, generally without treatment, into the river and its tributaries. The character and extent of this pollution was made the subject of an extensive special investigation in 1908, the results and findings of which are set forth in full detailed reports published in the 28th Annual Report of the Department, Vol. 11, pages 409–477, and pages 604–631 inclusive. Without discussing in any detail the findings of these reports, it may be stated briefly that these investigations clearly established the fact that the Hudson river above Albany receives gross pollution from raw or only partially treated sewage of some 60 cities and villages comprising a total population of some 450,000 persons, and from the industrial wastes of some 150 mills and factories. The effect of this pollution upon the successful operation of the Albany filtration plant is obviously a serious matter. This pollution is clearly shown in the results of comparative analyses of samples of Hudson river taken at successive points along its course from the upper reaches above points of pollution, where the water is practically saturated with dissolved oxygen, the organic matter represented by oxygen consumed only 7.00 parts per million, and the total bacteria only 300 per cubic centimeter, to the lower point in the river just above the Albany intake where the dissolved oxygen has been reduced to about 50 per cent saturation, the organic matter increased to 20 parts per million, and the bacteria increased to 8,000 per cubic centimeter.

It is not to be inferred that the full effect or burden of the pollution from all of these municipalities and industrial plants is imposed upon the water filtration plant, for as was clearly pointed out in one of the reports referred to, there is a very marked recovery in the purity of the Hudson river due to self-purification of the water as it flows from the various points of pollution down the river. Two very significant facts do stand out clearly, however. One is, that the river does not readily recover from the heavy pollution from organic wastes contributed by certain classes of mills, particularly paper mills. This is clearly shown by a comparison of "oxygen consumed" figures, which increase from 7.0 parts per million above pollution at Corinth on the upper Hudson, to 33.0 parts per million below Fort Edward, where maximum intensity is reached. Below this point in the river the "oxygen consumed," though reduced somewhat, still remains over 22.0 parts per million, and is practically 25.00 p.p.m. at a point just above confluence of Mohawk river.

The other important fact is that between the junction of the Mohawk and Albany's intake, a distance of about 10 miles, a very large population, approximating 130,000 people, and a considerable number of mills, contribute sewage and wastes directly to the river without any treatment whatsoever. Owing to the partial treatment of sewage of the other municipalities on the watershed situated above the confluence of the Mohawk, and the self-purification that is accomplished in the reaches of these rivers above this point, it is obvious that the pollution from these nearby municipalities is that which causes the principal burden upon the operation of the Albany filtration plant. This fact is clearly demonstrated by a comparison of the analytical figures in the reports above referred to, which show that nearly all of the pollution constituents in the river, including organic matter and bacteria, are increased approximately 50 per cent between the point of confluence of Mohawk and Hudson rivers and the intake of the Albany water works.

The highly infectious character of the raw water is well known and has been repeatedly demonstrated. Prior to the construction of the filter plant, the city suffered for years from an excessive typhoid fever death rate. Even since the introduction of filtered water, typhoid fever or gastroenteritis outbreaks have occurred at times when satisfactory operative conditions have been seriously interfered with.

It will be recalled that one of these outbreaks occurred in 1913, during the spring flood, when the filter plant was flooded and raw river water was pumped into the city mains. Although warnings were published in all the daily papers against the use of the public supply without boiling, the disregard of this warning resulted in the occurrence of some 232 cases of typhoid. A detailed description of this outbreak and the various actions taken by this Department in the suppression of it are covered in reports by the writer, published in the Annual Report of this Department for 1913.

Another instance occurred during the fall of 1917, when an undue prevalence of typhoid fever occurred in the city. The cause was at first apparently of obscure origin. The organic matter in the water during this period had been excessive. Alum treatment was not being applied to the water nor was this considered necessary in view of the fact that the water was being carefully filtered and chlorinated and that bacterial counts and B. coli were low. This type of organisms was not entirely absent, however, and after careful study of the situation by the Department the conclusion was reached that the cause of the typhoid fever prevalence was water infection. Upon advice of the Department, alum treatment was resumed. At the end of the incubation period following, due to the higher bacterial efficiency resulting from the alum treatment, the prevalence of the disease ceased.

Still again may be cited the recent outbreak of gastroenteritis in the city. During the latter part of February and the first part of March of the present year, a large number of cases of this malady occurred in the city, and upon investigation by the Department it was clearly shown that the water supply was the cause. It appears that some difficulty had been experienced by the city in securing shipments of alum, and with a limited supply of this chemical on hand, and with approaching floods in the river which would make the use of alum imperative, it had been decided to conserve this limited supply so that none was being applied to the water at the time of the outbreak. After a careful investigation, however, during which the cause of the outbreak was clearly traced to the water supply, the Department advised that alum treatment be resumed, a recommendation which was promptly carried out by the city authorities. Almost immediately on the resumption of the use of alum, and the resultant higher efficiency of filter operation, the outbreak of gastroenteritis subsided.

These experiences demonstrated clearly that with a water so heavily polluted as the Hudson river now is at the point of the city's intake, it is absolutely necessary that the highest degree of filter efficiency be maintained if the city is in the future to be free from a recurrence of gastrointestinal diseases. They mean, also, that without reservation every facility must be furnished to guarantee this efficiency and make it positive, simple, and uninterrupted. To accomplish this end will require not only the continuous application of alum throughout the year, as I have repeatedly advised, but will make desirable substantial changes in construction and operation of the filtration plant if the Hudson river supply is to be continued.

Sanitary Quality of the Filtered Supply

The operation of the purification plant is controlled by daily analyses, both chemical and bacterial. Samples are collected from various points in the process and at various times of the day. A study of the results obtained for the years ending September 30, 1917, 1918, and 1919, so far as the data were available from incomplete records kept during these years of the war period, shows a raw water, moderately high in color and turbidity and in organic matter, as shown by the figures for nitrogen in its various forms and for oxygen consumed. The total bacterial counts are excessive, and organisms of the B. coli type are present in large numbers. Analyses of the samples taken at various stages in the purification process show the reduction in color, turbidity, organic matter, and bacterial content. The final effluent is practically free from turbidity and only moderately colored. The total bacterial count is moderate, and practically no organisms of the B. coli type are isolated from the filtered and chlorinated supply.

While these analyses show a very high degree of filter efficiency and a quality of filtered water of very high degree of purity, it must not be overlooked that these results represent averages. They do not include individual days, or longer periods, when these high averages would not be reached, nor do they reflect the inherent difficulties under which the plant has at times been operated, nor the serious troubles from outbreaks of disease resulting from these difficulties previously referred to. They do, however, clearly demonstrate that even in the face of these difficulties it is possible, with the careful supervision now given the plant, to turn out a filtered water supply of high average standard; and furthermore, that one is justified in assuming that if these difficulties and objections can be removed or overcome, a plant of this type, with equally careful operation, will produce continuously and without interruption a water supply of equally high standard.

Changes Needed in Construction and Operation of Water Supply System

(a) Filtration Plant:

Attention has already been called to the important fact that the organic content and turbidity of the Hudson river are at certain times of the year very high, and that at such seasons, particularly since 1914, it has been impossible to pass all of the effluent from the preliminary filters through the secondary filters. In fact, at times it has been necessary to by-pass some 60 per cent of the preliminary effluent around the secondary filters. This preliminary effluent is, owing to the present character and construction of the preliminary filters, not highly purified, and were it not for the final chlorination of this water, would be unsafe to deliver into the city mains. In other words, at these seasons of high turbidity and organic content the secondary filters are entirely inadequate in capacity to treat the whole supply, and the preliminary filters, though adequate in capacity, are not at present of proper construction to produce alone a water of satisfactory quality.

Again, the present sedimentation tank is in one unit, which necessitates its being put entirely out of service during periods when cleaning is required. Its large area without baffle walls permits cross-currents which decrease its settling efficiency. Furthermore, there is now no satisfactory means of mixing chemical solutions, nor any effective time interval provided for satisfactory coagulation to occur before the water enters the sedimentation basin.

It is obvious, then, that if the water is to be treated properly at all seasons of the year it will be necessary to correct these defects and supply the necessary omissions that now exist. A study of the existing structures with reference to the requirements that must be met indicates that it would be a simple and comparatively inexpensive matter to revise the present method of filtration without considerable alteration of structures and equip the entire plant on a straight "mechanical" basis. It would seem that this could best be done by:

1. Abandoning entirely the secondary filters as such, utilizing the various filter units for other purposes, such as a mixing channel, preliminary auxiliary settling chamber, and clear water storage.
2. Divide the present sedimentation basin by a division wall, making two independent basins or more of suitable shape; or dividing the basin by curtain or light baffle walls thus increasing the settling efficiency of the basin. This latter alternative might make necessary or desirable the use of conversion of one of the abandoned secondary filter units into a preliminary auxiliary basin of small capacity for temporary use when the large basin is to be cleaned.
3. Converting present preliminary filters into straight mechanical filters by removing present coarse sand and replacing with sand of approximately 0.5 mm minimum e|ective size and leaving the effective depth at least 30 inches.

If these changes were carried out, the filter plant as a whole would not only be improved in efficiency and flexibility of operation but would permit of being operated with more positive and uniform results. Capacity of the remodeled preliminary filters would take care of a water consumption some 50 per cent greater than the present; and with proper and continuous coagulation and the same careful supervision now given the plant, would in connection with final chlorination furnish a water of high sanitary quality at all seasons of the year.

(b) Pure Water Conduit:

This clear water conduit, as previously pointed out, is under practically no internal head or pressure and is constructed for a considerable portion of its length in the bed of the old Erie canal, with a covering of only 2 to 5 feet above it. The conduit is composed of only a thin shell of iron surrounded with concrete, the thickness of which at the crown is less than 6 inches. It has been laid some 20 years, and an inspection years ago indicated that structurally it had deteriorated considerably and its strength impaired.

The water in the canal which flows in close proximity above the conduit receives considerable pollution, and it is obvious that any break in this line, or even leakage which would admit canal water into the conduit would be a serious matter, particularly since no treatment of this water takes place after leaving the filter plant, nor is any in fact practicable in a satisfactory manner at the pumping station. Although daily samples are collected of the water from this conduit near the pumping station for the purpose of determining contamination from leakage or breaks, it is obvious that should a break occur, and infected water enter this conduit, the condition would not be known or detected by means of these samples (which require at least 24 hours time for incubation) until after the damage had been done.

I can not too strongly emphasize the serious menace presented by this conduit, if its structural integrity is such as present information indicates, and it obviously represents potentially one of the weakest links in the water works system. To repair it satisfactorily appears difficult if not impracticable. It has been suggested that the canal now abandoned for transportation purposes might be secured from the State, filled in, and made a street. This, however, would involve uncertain structural features, and from a sanitary standpoint might involve even worse dangers from proximity to street sewers or other contaminating sources which would be created.

After a careful study of the situation with respect to this conduit, and with a full realization of the disastrous results that might follow an unexpected break or a sudden leakage into this gravity conduit, now weakened and unprotected, and the practical difficulty of correcting or meeting such an emergency, even assuming its remoteness, I am convinced that the only safe course to adopt now is to abandon this conduit at the earliest possible time and replace it with a new line of heavy castiron pipe. In this case there would be no serious objection to the filling in of the old canal and its conversion into a new street, in which case it would be wise so to develop it that no sewers or other possible contaminating sources would be constructed in the street or in any proximity to the new conduit.

(c) Excessive Water Consumption:

The present daily water consumption in the city is approximately 200 gallons per capita, which is about twice what it should be for a city of this character and indicates a serious waste of water. While part of this waste may be and is undoubtedly due to leakage in the mains, the major part is also undoubtedly due to carelessness in the use of water by the residents themselves and to leaky fixtures in household plumbing.

The seriousness of this is manifest, for it means that the expense of pumping and the cost of filtering the water, though probably not proportionately doubled, is largely increased. This situation has been repeatedly pointed out in reports of the present Commissioner of Public Works, Mr. Wallace Greenalch, and although nearly 50 per cent of the services in the city have been metered, largely through his efforts, the water consumption and waste is still excessive and should be reduced. This can only be effectively done through the metering of all services in the city, supplemented by a water leakage survey of water mains, and by enactment and enforcement of regulations requiring the repairing of leaky fixtures in all domestic and manufacturing service systems.

(d) Unsatisfactory Sanitary and Physical Quality of Upland Supplies:

It has been previously pointed out that the quality of water furnished from Rensselaer lake, from Patroons and Sands creeks, and from Maeslandt kill, are objectionable for domestic purposes on account of actual or potential contamination upon their respective watersheds, or inadequate purification. The total yield of these supplies is not much over 3,000,000 gallons per day, representing a little over ⅛ of the total supply. The use of these supplies under existing conditions is a menace to the health of those who are served by them, and to purify them adequately would be of questionable economy.

The necessity for using these supplies, if the changes recommended above for remodeling and increasing the capacity of the present filtration plant are carried out, would be removed, and in view of the unsafe quality of the upland sources of supply and the doubtful economy of satisfactorily purifying them, I am of the opinion that it will be wiser to abandon them entirely, with the exception perhaps of the Maeslandt kill supply which might be retained for special purposes at the filtration plant.

(e) Pollution of Hudson River Causes Overload on Filtration Plant:

The pollution of the Hudson river above the Albany water intake, due to the discharge of sewage and factory wastes, has already been discussed. Emphasis was laid on high organic content, represented analytically by "oxygen consumed," and contributed largely by certain mill wastes, more especially paper and pulp mills located along the upper Hudson at and above Glens Falls. Emphasis was also laid upon the excessive bacterial contamination from raw sewage discharged by certain nearby municipalities situated on the river above the city, including Mechanicville, Troy, Green Island, and Watervliet.

The first of these sources of pollution, the organic matter, tends to interfere materially with the successful operation of the filtration plant, particularly at seasons when turbidity in the water is very low. The second of these sources of pollution, the bacterial contamination from raw sewage discharge, tends to make this interference in the operation of the filtration plant a serious matter since this sewage is comparatively fresh and therefore highly infectious.

It would seem highly desirable, therefore, in connection with the improvements to be carried out as outlined above, that the attention of the city and State authorities be directed toward a reduction of the pollution in the river above the intake, particularly from the two sources referred to. Section 87 of the Public Health Law would apparently authorize the city, with the approval of the State Commissioner of Health, to institute proceedings against most of these municipalities to require them to install sewage disposal works for the purification of the sewage now discharged by them in a raw state into the river, now that the City of Albany has already made provision for the treatment of its own sewage. Concerning the reduction of mill wastes, however, it is probable that legislation would be necessary before these mills could be required to remove or purify their wastes, since most of these mills were in existence prior to the act of 1903 prohibiting such pollution and are at present specifically exempt from the provisions of this act.

Summary and Conclusions

Summarizing briefly the results of this investigation and in view of the foregoing it may be concluded:

1. That the principal source of supply, taken from the Hudson river, is in its raw state grossly polluted with sewage and factory wastes and is unsafe for domestic or drinking purposes without efficient purification.

3. That this water supply as delivered to the city, after purification by means of sedimentation, partial coagulation, preliminary filtration, partial secondary filtration, and final chlorination, has been generally of good sanitary and physical quality; but that owing to defects or difficulties in construction and operation this supply has at times been insufficiently purified and the cause of undue prevalence or outbreaks of waterborne disease.

3. That owing to the highly infectious character of the raw Hudson river supply, to the defects and difficulties in construction and operation of the filtration plant, certain changes and alterations in arrangement, construction, and operation of the filtration plant are necessary.

4. That the pure water conduit is in its present location and structurally deteriorated condition subject to possible breaks or leakage and is potentially a serious menace to health.

5. That the upland sources of supply taken from Rensselaer lake, Patroons and Sands creek, and Maeslandt kill, are subject to dangerous contamination, are either not purified or are inadequately purified, and are in their present condition a menace to health.

6. That a large amount of the water furnished the city is wasted through leakage in water mains, leakage in domestic service fixtures, and carelessness on the part of residents in the household uses of water, the result of which is largely to increase the cost of construction, equipment, and operation of the filtration plant and pumping stations.

Recommendations

In view of the conclusions above reached, I beg to submit the following recommendations:

1. That with respect to the filtration plant the following changes and additions be made in construction and operation:

   (a) The present sedimentation basin be subdivided into at least two settling compartments by suitable division walls in order to provide more effective sedimentation.

   (b) That a preliminary coagulation and mixing basin be arranged in one of the present slow sand filters to be abandoned, in order to provide proper mixing of chemical solutions and better coagulation.

   (c) That the present secondary filters be abandoned as such, the sand removed, and the filter units converted into a clear water basin a coagulation and mixing tank, and possibly an auxiliary sedimentation tank.

   (d) That the preliminary filters be converted into straight mechanical filters by removing present coarse sand and substituting a finer sand of suitable effective size, the depth of which should be kept at least 30 inches.

   (e) That the raw water before filtration be subjected to alum treatment and sedimentation without interruption at all seasons of the year.

2. That the pure water conduit leading from the filter plant to the pumping station, the structural condition of which has been found to be impaired, be abandoned and replaced by a castiron main; and that during the interval of this replacement an emergency chlorination plant be installed at the Quackenbush pumping station for emergency use in case of a break or leakage into the line, this provision to be supplemented by a systematic plan of inspection and action which will permit the detection without delay of any break or leakage in the line and the immediate application of corrective measures.

3. That the present upland sources of supply derived from Rensselaer Lake, Patroons and Sands creeks, and Maeslandt kill, be abandoned for domestic and manufacturing purposes as soon as the changes and additions to the filtration plant recommended above are completed.

4. That additional steps be taken at once by the city to reduce the present excessive water consumption and leakage by —

   (a) The introduction of water meters on all household and manufacturing service lines.

   (b) A water leakage survey of all streets and domestic service mains in the city and the repairing of all leaks found.

   (c) The institution of a house to house inspection of domestic plumbing systems and the establishment and enforcement of regulations requiring property owners to repair all leaks discovered.

5. That steps be taken by the city, with the cooperation of this Department, and if necessary through proceedings instituted under section 87 of the Public Health Law, to induce or require the nearby municipalities on the Hudson river above the Albany water intake so to treat their sewage as to lessen the burden now imposed upon the filtration plant resulting from this pollution.

In closing, I desire to acknowledge the courteous assistance rendered during the investigation by Mr. Wallace Greenalch, Commissioner of Public Works, Dr. Arthur Sautter, Health Officer, and Mr. G. E. Willcomb, Supervising Chemist of the filtration plant.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *April* 12, 1920

The water of this supply is used by the New York Central and the Boston and Albany railroads for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on November 10, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were satisfactory, and that the results of the inspection and the analyses of the samples, together with the results of previous inspections and analyses, indicate that the water is of satisfactory quality for human consumption. A copy of the report accompanied this data. Based on this information, the United States Public Health Service on November 17, 1920, issued a provisional certificate permitting the temporary use of the water for drinking and culinary purposes in interstate traffic.

ALBION

A reinspection of the water supply of the village of Albion was made on October 16, 1920, by Mr. Earl Devendorf, assistant engineer. Previous inspections of this supply were made by this Department in 1915, 1916, and 1919, the reports upon which are published in the Annual Reports of the Department for the respective years.

Albion is a village of some 4,700 inhabitants located in the central part of Orleans county, 30 miles northwest of Rochester. The public water supply is owned by the village and operated under the direction of a Board of Trustees, of which Mr. F. H. Rhodey is president and Mr. L. Woolston is superintendent. The supply is derived from Otter creek, and from driven wells located near the purification plant. The water flows by gravity from the storage reservoirs to the purification plant, from which it is pumped after treatment into the village distribution system, the excess over consumption going to a standpipe located in the village having a capacity of some 275,000 gallons. Water from the wells is also pumped after purification into the village distribution system. About 90 per cent of the inhabitants are served with the public water supply.

The purification plant consists of sedimentation and coagulation basins, two gravity mechanical filters, and hypochlorite tanks equipped with constant head orifices. The amount of alum being used at the time of the inspection was said to be 120 pounds per day, or 150 pounds per million gallons, which with the amount of water pumped last month amounted to 1.05 grains per gallon. The amount of hypochlorite, the lime being used, was 11 pounds per million gallons or .43 p.p.m. The filter is washed twice daily, using approximately 20,000 to 30,000 gallons of filtered water. In washing the filter air is used to break up the sand for approximately five minutes. Then water is turned on for about ten minutes. After washing the filter water is wasted for a period of about ten minutes.

The engineer from this Department was informed that about a year ago the water consumption arose suddenly above the normal amount pumped and has since remained above the previous record of pumping. For this reason it is believed that there is a large leak or leaks in the distribution system. Unless adequate means are taken to discover and eliminate this leakage, the capacity of the present filter plant may soon be exceeded and it will be necessary for the village to consider the matter of increasing the capacity of the present purification plant. The village has not engaged the services of a consulting expert to supervise the operation of the plant, as recommended in the last report.

Samples of the water taken on October 1, 1920, and analyzed by the Division of Laboratories and Research, showed the following bacteriological results:

	Raw water	Treated water
Bacteria per c.c 20°C	1600	17000
Bacteria per c.c 37°C	530	5400
Colon type in 10 c.c	3+0—	3+0—
Colon type in 1 c.c	1+2—	3+0—
Colon type in 1/10 c.c	0+3—	0+3—

The results of the examination show a bacterial increase over the raw water total count, indicating that the filtration was not effective as regards the removal of bacteria. The presence of B. coli in the 10 c.c. and 1 c.c. inoculations examined indicated a water of unsatisfactory sanitary quality and that the purification plant was not being effectively operated.

As a result of the inspection it was recommended that in view of the recent unsatisfactory analytical results indicating the ineffective operation of the purification plant, the officials in charge of the public water supply give more careful attention to the quantities of chemicals being used and the regularity of their application, increasing the quantity if necessary; and that they continuously operate the purification plant in such a manner as to furnish a water of satisfactory sanitary quality at all times to the residents of Albion; that, as previously recommended, the village employ the services of a competent expert to supervise the operation of the purification plant; and that the village authorities in charge of the public water supply endeavor to locate and eliminate any leaks in the public distribution system.

AMENIA

A reinspection of the water supply of the village of Amenia was made on May 29, 1920, by Mr. W. J. Erickson, engineering assistant. A previous inspection of this supply was made by this Department in 1912, the report upon which is published in the Annual Report of the Department for that year.

Amenia is an unincorporated village in the northeastern part of Dutchess county, on the Harlem division of the New York Central railroad. It has a present population of about 800, practically all of whom are served by the public water supply. This supply is owned and operated by the Amenia Water Company.

The water is derived from two sources: a spring or upland supply, and two driven wells in the flats south of the village. From the spring supply the water flows by gravity to the distribution system, consisting of 2¾ miles of mains varying from 1 to 6 inches in diameter. There is no method of accurately determining the consumption. The well supply which is usually used only in the summer months is pumped into the mains against the pressure maintained by the reservoir. The system is practically the same as described in the previous report.

The wells are located near the banks of a stream 175 feet from the main street in the village. One is 10 feet and the other 20 feet from the stream. They are driven through 30 feet of clay to water-bearing gravel.

The ground immediately around the wells is flat and low, through which the stream meanders. One of the wells is located under the pump house, while the other is about 15 feet from it. The latter well opens into a 5-foot by 5-foot wooden box. The top of the casing is open to allow the water to flow over the top, which acts as a circular weir. There is a possibility for the creek water to enter the well through this open casing at times of high water and thus pollute the supply. There are numerous houses and 5 privies within 100 feet of the wells. House drains from above buildings discharge into the stream near the wells. Adjacent to the wells is the gas manufacturing plant, which is operated by the same company which owns the water supply. The spent carbide is strewn over the ground and the liquid seeps over the wells, making a very unsightly appearance.

As a result of this inspection it was concluded that the upland supply is derived from a source which should yield a satisfactory supply if properly protected from pollution, but that the well is very badly located and subject to contamination.

It was therefore recommended that the company continue to maintain the upland supply in a satisfactory condition, making regular inspections to locate and eliminate any source of pollution; that a new supplementary supply of satisfactory sanitary quality be developed, and upon the completion of the work the wells be abandoned; and that, pending the development of a new supply, the casings of the wells be provided with water-tight caps and the pump house and vicinity of the wells be kept in a neat and sanitary condition.

AMITYVILLE

A reinspection of the water supply of the village of Amityville was made on May 11 and May 20, 1920, by Mr. Henry Ryon, assistant engineer. A previous inspection of this supply was made by this Department on May 13, 1915, a report upon which is published in the Annual Report of the Department for that year.

Amityville is located on the south shore of Long Island, in Suffolk county, about 34 miles from New York city. The resident population of the village is about 3,500, increasing, however, to about 4,000 during the summer months.

The water supply is owned and controlled by the Amityville Water Works Company. The source of the supply consists of four driven wells, from which the water is pumped into the distribution mains, the surplus going to a standpipe. The plant is located on the south side of the railroad tracks a little west of the center of the village. About 80 per cent of the population is served with water from the village supply. The water consumption averages about 150,000 gallons per day during the winter and about 250,000 gallons per day during the summer, corresponding to per capita rates of about 45 and 65 gallons per day. The maximum and minimum rates of consumption during 1919 were 432,000 and 143,000 gallons per day respectively.

Three of the four wells are located within about 75 feet of the pumping station, and a third in the basement of the electric power station a little over 100 feet west of the pumping station. The well casings are all 10 inches in diameter. Two of the suction pipes extending down into the casings are 8 inches in diameter, one 6 inches, and the fourth 4 inches in diameter. The wells are said to be 60 feet deep, the lower 18 feet, consisting in each case of a slotted brass strainer. In three of the wells the strainers are attached to the suction pipes and not the casing, one length of casing having been withdrawn in each case after the strainer was placed. In the fourth well, however, known as the North well, the strainer is attached to the casing, and the suction pipe hangs free within it. All the casings have been cut off about 11 feet below the surface of the ground. Four-foot circular brick manholes fitted with conical wooden covers have been provided to protect the three wells located near the pumping station. The well in the basement of the electric power station is protected by a small square manhole covered with removable plank. The vertical sections of the wells are at the level of the top of the casings connected to horizontal suctions leading to the main suction header in the basement of the pump house.

The ground around the wells slopes away from them in all directions, and the possibility of surface water reaching them is very remote even at times of heavy rainfall occurring when the ground in the vicinity is not in condition to absorb much water. The possibility of the accidental contamination of the water by any person other than the attendant is practically impossible, since the plant is surrounded by a high wire fence surmounted with several strands of barbed wire and the gates of the enclosure kept closed and locked at all times.

The density of the population within one-quarter of a mile of the wells is equivalent to about 1,100 people per square mile, within one-half mile of the wells about 750 people per square mile, and immediately outside of this area about 150 persons per square mile. The possible sources of pollution in the immediate vicinity of the wells consist of a privy provided with removable wooden container located on the water company's property about 75 feet from the nearest well, and the privy of the Long Island depot, which is provided with earth vault and no container located about 250 feet from the wells.

There is no sewerage system in the village, all the houses having privies and cesspools. The nearest house is about 300 feet from the wells. About 1,000 feet north of the wells there are three private insane asylums, provided with disposal plants, at all of which the method of finally disposing of the effluent consist of absorption by the soil. The high free ammonia and nitrate content and the high chlorine content of the water, as shown by the results of the analyses, seem to indicate that polluting matter from the privies, cesspools, and sewage disposal plant is reaching the wells; and the material increase in the chlorine figure and the great increase in the free ammonia figure over the figures for 1915 seem to indicate that the quantity of polluting matter is becoming greater each year. It is possible, however, that at any time, due to changes in the ground water flow caused by variations of weather conditions or the draft on the wells, active contamination may reach the water, and for this reason the water supply cannot be regarded as entirely satisfactory. It is apparent, as pointed out in our previous report, that the increasing population of the village will eventually affect the quality of the water and render it dangerous for human consumption without treatment. It would seem advisable that samples of the water should be frequently taken and analyzed to detect the presence of active contamination, and should the presence of such contamination be detected apparatus for the proper treatment should be installed and put in operation.

Appearances seemed to indicate that during the period of heavy rains and thaws just prior to the time of the inspection the ground water had been higher than normal and possibly above the tops of the well casings. This would mean, particularly in the North well, that the water from the upper strata of soil had entered the wells through the space between the casing and the suction. No examination of the water from this strata has been made, and since it is possible that this water might contain active pollution when the water from the lower strata might not, it would seem advisable to take measures to prevent the entrance of such water into the wells, at least until it has been positively demonstrated that its quality is satisfactory. Sealing the space between the casings and suctions and carefully watching the wells at times of high water would seem desirable.

The well in the electric station is in the lowest part of the basement, under the pump mentioned below, and there is a possibility that water spilled on the floor of the basement near the pump might find its way into the well through the annular space between the casing and the suction. This annular space is apparently protected by a ring, but it was not possible for the engineer making the inspection to determine whether or not the joint was tight. It would seem desirable that the opening between the casing and the suction should be made absolutely watertight. It would also seem advisable that the manhole at the top of this well should be provided with a concrete bottom and the top arranged so that the water will drain away from it, and that a new cover for the manhole should be provided.

At the time of the inspection the standpipe, which is located only a few feet from the south well, was leaking at the rate of probably 15 or 20 gallons per minute; and this leakage flowing into the valve chamber at the foot of the standpipe and from there through the pipe installed for the purpose into the manhole at the top of the south well. This manhole, at the time of the inspection, with the pumps operating, contained several feet of water, indicating, since there is no floor in the manhole, that the soil between the surface and the water bearing strata is not extremely porous; and also that while the annular space between the casing and the suction pipe is open, conditions at the bottom of the casing and above the strainer are apparently such that water does not pass very rapidly through the annular space between the casing and the suction to the gravel around the strainer. The water leaking through the standpipe is, of course, of as satisfactory sanitary quality as that from the wells, but the fact that it is exposed for a short distance as it passes from the standpipe to the south well to possible accidental or wilful pollution makes the existing condition an undesirable one, and it would therefore seem that steps should be taken to repair the standpipe immediately and thus remove one possible source of contamination of the water.

In April, 1920, there was an outbreak of typhoid fever in Amityville. Seven cases were reported, the onsets of all of which occurred about April 10. The patients were of different ages and social conditions and widely scattered over the village, one patient living outside of the village limits. To date, no evidence has been obtained definitely to fix the cause of the outbreak; and as may be inferred from the facts about the water supply given above, there is nothing to prove that the quality of the water supply was connected with the outbreak of typhoid, although as was pointed out above, there is a possibility that active contamination may have reached the water supply due to changes in the ground water flow or by accidental means. While, therefore, there is no evidence definitely to show that the water supply was in any way connected with the epidemic, this does not prove that the quality of the water supply was not the cause of the typhoid, and for that reason the conditions surrounding the supply and the quality of the water should be carefully watched, particularly at times of extremely dry and extremely wet weather, to detect any indication of active pollution.

From the results of the investigation of the sanitary quality of the water supply of Amityville, it was concluded that while the water is usually free from active contamination, many potential sources of pollution exist, and that the examination of the water indicates that it receives a large amount of polluting matter which under normal condition is rendered inactive by passing through the soil but which may become active at any time.

It was therefore recommended —

1. That the water company continue to exercise regular and careful supervision over the operation of the plant and the conditions of the ground around the pumping station and wells.
2. That samples of the water be examined at frequent intervals, and particularly at times of extremely dry and extremely wet weather conditions, to detect the presence of any active contamination.
3. That should any such active contamination be discovered, the company immediately proceed to sterilize the water with liquid chlorine or purify by other satisfactory means, and if possible discover and remove the source of contamination.
4. That the leak in the standpipe be immediately repaired.
5. That the present leakage from the standpipe and the water from the valve manhole at the foot of the standpipe be disposed of by means other than draining into one of the wells.
6. That measures be taken to prevent the entrance of any water into the wells through annular space between the well casings and the suctions.

ANTWERP

A reinspection of the public water supply of the village of Antwerp was made on October 22, 1920, by Mr. A. I. Howd, assistant engineer in this Department, a previous inspection of this supply having been made by the Department on September 14, 1918.

Antwerp is an incorporated village with a population of about 1,100, and is located in the northeastern part of Jefferson county, about six miles northeast of Philadelphia. About 90 per cent of the total population are served with water from the public supply.

The water supply is derived from Indian river, and is pumped into the mains without purification. Above the intake the Indian river has a watershed area of about 157 square miles, on which there is a scattered population of 3,000 people. The stream receives pollution from cultivated fields, pastures, and the farm houses and small settlements on it, and is also subject to pollution from the village of Antwerp itself. The waterworks pumping station is located at a dam across the river at Main street, and the intake pipe extends about 1,200 feet up the bed of the stream. The sewage from some twenty properties discharges into the pond below the intake, and the sewage and sink wastes from about six properties discharge into the river directly above the intake of the water supply.

Our report of the inspection of 1918 pointed out that the public water supply of the village, pumped unpurified from the Indian river, was subject to contamination and unfit for human consumption. It was recommended in that report that the supply either be abandoned or some suitable method of purification installed. The present inspection discloses the fact that none of these recommendations had been carried out.

In the early part of October, 1920, the village experienced an outbreak of typhoid fever. There were five cases and one death. An investigation disclosed the fact that milk, ice cream, and shell fish might reasonably be excluded as being possible causes of the outbreak. All of the cases had access to the public water supply. It seems probable, therefore, that the cause of the outbreak was the use of polluted water from the public supply, and that the outbreak might have been avoided had the previous recommendations of this Department relative to the purification of the water been carried out.

It was therefore recommended that the village authorities take immediate steps to carry out the recommendations of the previous report; that the present water supply either be treated by some suitable method which will furnish a safe and wholesome water, or abandoned and a new source of supply developed; and that pending the installation of a purification plant or the securing of a new supply, the present supply be continuously sterilized by the application of liquid chlorine.

BABYLON

A reinspection of the water supply of the village of Babylon was made on May 20, 1920, by Mr. Alfred Mullikin, assistant engineer. A previous inspection of this supply was made by this Department in 1915, a report upon which is published in the Annual Report of the Department for the year 1916.

Babylon is located in the southeastern part of the town of Babylon, on the Montauk branch of the Long Island railroad, about 39 miles from New York city. The present population is estimated at about 3,300, of whom all are served with the public water supply. The waterworks are owned and operated by the Sumpwams Water Company.

The water supply is derived from four driven wells located in the northeastern part of the village, about 400 feet east of a branch of the Sumpwams river, on a triangular plot of land about 10 acres in area owned by the water company. In addition to the village of Babylon, water from these wells is also supplied to the unincorporated villages of Lynhurst and West Babylon. The average daily water consumption varies. The summer consumption is approximately 350,000 gallons, and the winter consumption approximately 250,000 gallons, or about 75 gallons per capita per day.

The wells consist of four 8-inch driven wells and one 6-inch well, ranging from 45 to 60 feet in depth. Three are covered with stone covers and one with a wooden cover. The 6-inch well north of the plant and the 8-inch well south of the plant have been abandoned. There are no houses in close proximity to the wells except the residence of the engineman, which joins the pumping plant. The sewage of this residence flows through a tile pipe into a brick cesspool located 150 feet or more south of the nearest well. This pipe passes within 3 or 4 feet from one well, which has been abandoned, in accordance with the recommendations of this Department. The sewage from a toilet located at the extreme northeast corner of the plant flows into a brick cesspool about 150 feet west of the wells.

The results of the analyses of samples of water taken at the time of the inspection showed a water clear, colorless, and very soft. The figures for nitrogen in its various forms, with the exception of albuminoid ammonia, were rather high, indicating the presence of some decomposing and decomposable organic matter, most of which has been oxidized by the natural processes of purification in its passage through the soil. The chlorine is normal for the locality. The total bacterial count was fairly high but the absence of any bacteria of the colon type showed a water free from active contamination at the time the samples were collected.

As a result of the reinspection of the public water supply of Babylon, it was concluded that the supply was in fairly satisfactory condition at the time of the inspection, and it was therefore recommended that the authorities in charge of the public water supply continue their careful supervision over the area in the vicinity of the wells to prevent any possible pollution of the soil.

BALDWIN

A reinspection of the water supply of the village of Baldwin was made on May 18, 1920, by Mr. Alfred Mullikin, assistant engineer. A previous inspection of this supply was made by this Department in 1915, the report upon which is published in the Annual Report of the Department for that year.

Baldwin is located in the southern part of the town of Hempstead, on the Montauk branch of the Long Island railroad, about 24 miles from New York city. The population is estimated at approximately 4,000, of which about 50 per cent are served with water from the public supply. The water works are owned and operated by the Baldwin Water Company.

The water supply is derived from six driven wells about 30 feet deep located near Milburn creek about a half mile northeast of the village and a quarter of a mile north of one of the pumping stations of the Brooklyn waterworks. From the wells the water is delivered by pumping into a distribution system consisting of about 30 miles of castiron pipe. An elevated steel tank 22 feet in diameter and 30 feet high, having a capacity of 110,000 gallons, is located on a tower near the pumping station and acts as an equalizing reservoir.

From the recent inspection it appears that the recommendations of the previous reports of this Department have been carried out. The old cesspools at the engineer's residence have been abandoned and a new tar-coated brick and cement cesspool constructed 95 feet west of the nearest well. This cesspool is cleaned out every 14 days and the contents hauled to a remote place for final disposal. The water company has purchased additional land in an easterly direction to the creek about 250 feet away. Analyses of the water are made once a year.

The results of the analyses of samples of water taken at the time of the inspection show a water slightly turbid, colorless, and moderately soft. The figures for nitrogen in its various forms are rather high, and indicate the presence of decomposing and decomposable organic matter. The value for chlorine is above normal for the locality. The total bacterial count is high for a well water, but no bacteria of the colon type were found, indicating that the water was free from contamination at the time the samples were taken.

As a result of the reinspection of the public water supply of Baldwin, it was concluded that the authorities in charge of the water supply have carried out the previous recommendations of this Department, and that the public water supply of the village, although not dangerously contaminated at the time of this inspection, is subject to pollution which, while apparently rendered inactive in its passage through the soil, may at any time become active and dangerous.

It was therefore recommended that lids or covers be provided for the tile casings to prevent surface wash and foreign matter from entering the well supply, that the wooden pits surrounding the tile wells be made of brick or some impervious material in order that a watertight condition may exist, and the walls extended sufficiently above the surface of the ground to prevent surface wash from entering the wells, and that the village authorities maintain a careful sanitary patrol over the area in the vicinity of the wells at all times.

BALDWINSVILLE

Reinspections of the water supply of the village of Baldwinsville were made on January 29, 1920, by Mr. Alfred Mullikin, assistant engineer, and on May 27, 1920, by Mr. Earl Devendorf, assistant engineer. A previous inspection of this supply was made by this Department in 1918, a report upon which is published in the Annual Report of the Department for that year.

Baldwinsville is situated on both sides of the Seneca river, in the northwestern part of Onondaga county, some 15 miles north of Syracuse. It has a population of 3,200, 90 per cent of whom are served by the public supply.

The water supply is owned by the village and operated under the direction of the Board of Water Commissioners. The supply is derived from a shallow well 20 feet deep, having a steel casing 20 feet in diameter provided with a conical steel roof. The well is located in the southwestern section of the village, and the water level in the well stands about 10 feet below the ground surface. The water is pumped to a standpipe, from which it is distributed by gravity to the village distribution system.

The ground surrounding the well is graded in such a manner as to prevent surface water from coming in contact with the well casing. The 6-inch tile sewer line located about 100 feet north of the well is still in use.

Samples of water were collected on May 27, 1920, and sent to the Division of Laboratories and Research for analyses. The results of these analyses show a hard water of good physical quality as regards color and turbidity. The amount of nitrogen present in its various forms indicated the presence of moderate amounts of decomposing and decomposable organic matter. The total bacterial count of the sample collected from a tap in the village was very high, but this was probably due to the multiplication of harmless forms of water bacteria since the containers were three days in transit. The results of the bacterial examination show the absence of organisms of the B. coli type in all of the inoculations examined.

In view of the above, it was recommended that the village authorities consider the former recommendations of obtaining a new well supply from a point approximately 1,000 feet west of the present well, and that the village authorities install immediately a chlorination plant for the sterilization of the public water supply with liquid chlorine and operate the same in a careful and efficient manner until a new source of supply is obtained as formerly recommended.

BEDFORD HILLS (State Reformatory for Women)

Plans for a new 6-inch driven well, 50 feet deep, to be located 50 feet from the brook and 90 feet farther upstream than the three existing wells, were submitted to this Department for approval by the State Architect on September 13, 1920. The plans consisted of architect's drawing No. 2041, and specification No. 3599. After careful examination and full consideration of the essential features of the design, the plans were approved on September 17, 1920.

BERLIN

A reinspection of the water supply of the village of Berlin was made on October 11, 1920, by Mr. W. J. Erickson, sanitary inspector. Previous inspections of this supply were made by this Department in 1909 and 1917, the reports upon which are published in the Annual Reports of the Department for the respective years.

Berlin is an unincorporated village of about 750 inhabitants, located in the eastern part of Rensselaer county about 15 miles east of Troy. The waterworks are owned and operated by the Berlin Water Works Company. About 75 per cent of the population of the village use the supply.

The water is derived from a spring fed brook located southwest of the village, and from Kendall pond located about a mile and a half southwest of the village. The supply is conducted to a distributing reservoir of 250,000 gallons capacity located on a hill southeast of the village. From this reservoir the water is delivered to the consumers by gravity through a distribution system consisting of 2 miles of mains ranging from 1 to 6-inches in diameter, on which there are some 90 service taps none of which are metered. The consumption is about 75,000 gallons per day, a quarter of which is used for industrial purposes.

The supply was formerly derived from two brooks and two springs located about a mile southwest of the village; and from the outlet of Kendall pond at a point about one-half mile east of the pond. It was also possible to divert the water coming from the tailrace of the hydro-electric plant which drains its water from Kendall pond into the intake on the outlet of the pond. The two brook supplies and the southerly spring supply have, however, been abandoned, and since no water now overflows from Kendall pond, the supply is now obtained solely from the northerly spring and from the tailrace of the hydro-electric plant, and the watershed of the former outlet of Kendall pond. The water is taken from the pond through a flume, and after being used to turn a water turbine is emptied into a small basin across the road from the power station. From this basin it is conducted by an 8-inch main to the distributing reservoir.

The area tributary to Kendall pond is about .35 square mile in area. It is rather flat, and that part bordering the pond almost entirely wooded. There are nine camps on the shore of the pond whose privies are set back from the water and which are only used for a few weeks in summer. The watershed tributary to the stream that was formerly the outlet of the pond is about .1 square mile in area and on the steep side of a hill. The only possible source of pollution of a permanent nature on this watershed is the road and from the power station. Both are subject, however, to chance pollution by visitors and campers.

The spring supply is derived from several springs, the water from which after issuing from a shale formation flows over the ground in a natural stream. The intake was very poorly developed. It appeared to be only a small pool at the side of the stream. If there has been a dam it has been washed away by the spring freshets. The intake pipe, though screened by a ¼-inch wire mesh, was not visible because of the mud and leaves covering it. From this intake the supply flowed by gravity to the distributing reservoir a mile away. The watershed tributary to the spring supply which is about one-fourth of a mile in area, is unpopulated and only one little used road crosses the upper end of it. The only possible sources of pollution are from this road and from the pasturing of cattle.

From the above facts it was concluded that the spring supply is of reasonably satisfactory sanitary quality though subject to pollution from pasture lands, but that the Kendall pond supply is at times subject to pollution from campers on the shores of the pond, while its aesthetic quality is depreciated by high color.

It was therefore recommended that the spring supply be conserved by the construction of a small intake dam and basin and the Kendall pond used only when necessary; that the water company take immediate steps to prevent the pollution of the water from the sources mentioned in the body of the report, and that should any difficulty be experienced in doing this, they apply to this Department for the enactment of rules and regulations for the protection of the sanitary quality of the water supply.

BERNE (Camp Orinsekwa)

Inspections of the water supply used at Camp Orinsekwa, Warner's Lake, Albany county, N. Y., were made by Mr. Earl Devendorf, assistant engineer in this Department, on April 10, July 16, and September 9, 1920, and reports and letters of advice regarding the sanitary condition of the camp sent to Miss Jeanette Frank, owner of the camp.

BINGHAMTON

The water of this supply is used by the Delaware, Lackawanna and Western, the Erie, and the Delaware and Hudson railroads for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on October 18, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were satisfactory, and that the results of the inspection and the analyses of the samples, together with the results of previous inspections and analyses, indicate that the water is of satisfactory quality for human consumption. A copy of the report of November 13, 1920, accompanied this data. Based on this information, the United States Public Health Service on November 11, 1920, issued a certificate permitting the use of the water for drinking and culinary purposes in interstate traffic.

BRIDGEHAMPTON

A reinspection of the water supply of the village of Bridgehampton was made on June 3, 1920, by Mr. Alfred Mullikin, assistant engineer. A previous inspection of this supply was made by this Department in 1915, the report upon which is published in the Annual Report of the Department for that year.

Bridgehampton is located in the eastern part of the town of Southampton, on the Montauk branch of the Long Island railroad, about 97 miles from New York city. The population has a slight seasonal variation, and amounts to 1,475 in winter and 2,500 in summer, all of whom are served with water from the public water supply. The waterworks are owned and operated by J. A. Sandford & Sons, Inc.

The water supply is derived from three driven wells located some 2,000 feet southeast of the railroad station, in a thickly populated section of the village. From the wells the water is pumped into tanks under air pressure, and then it is forced through a distributing system consisting of some 4¼ miles of castiron pipe ranging from 2 to 6-inches in diameter.

The wells are located in the basement of a hardware store owned by the water company, and consist of two 6-inch driven wells, 75 and 85 feet deep, respectively, and one 3-inch driven well 315 feet deep. The top of these wells terminate in the bottom of a brick pit irregular in plan, measuring 14 feet by 12½ feet with a depth of 11 feet below the basement floor. The basement floor is about 5 feet below the surface of the ground. The pit is provided with a concrete bottom over which a depth of about 2 feet of water containing oil remains. This water accumulates from leakage from the pumps and from two spiggots connected on the discharge line which drain directly into the pit. Due to old and worn construction material both in the foundation and well casings, it is possible that the accumulated waste may become a source of pollution. The water is pumped from the pit occasionally by the operation of a 1½-inch rotary pump. The strata through which the wells pass is loam and clay to a depth of 5 feet, sand to a depth of 70 feet, clay to 100 feet, sand and gravel to 135 feet, gray clay to 140 feet, sand to 170 feet, gray clay with fragments of shells to 190 feet, sand to 220 feet, sand and lignite to 230 feet, lignite to 237 feet, sand to 275 feet, lignite to 280 feet, clay to 290 feet, and white sandstone formation to 312 feet. The clay strata through which the wells pass are probably small pockets. Such formations are characteristic of Long Island, and these layers of clay are not necessarily of great protective value.

Aside from the area of the dwelling house, no area of land is reserved for the water supply. The plant is located in a thickly populated section of the village and indirect opportunities for pollution are numerous. The village is not provided with a sewerage system, the houses being served by privies and cesspools. The nearest privy is about 200 feet south of the wells. There is a cesspool approximately 300 feet southwest of the wells which provides for three houses just west of the plant. North of the plant there are numerous houses each of which is provided with an individual cesspool, the nearest being 200 feet distant from the wells. About 200 feet east of the plant there is a graveyard.

From the recent inspection it appears that the Water company has in part carried out the previous recommendations of this Department, in that one of the two privies within 200 feet of the well supply has been removed; that watertight removable containers are not provided for all privies within 500 feet of the well supply; that a sewerage system has not been constructed to take care of the sewage in the vicinity of the wells; that analyses of the water have been made about once a year.

As a result of the inspection it was recommended that the Water company carry out at once our previous recommendations; that all privies within a distance of 500 feet from the wells be provided with water-tight containers, and all cesspools within that distance be made water tight; that the Water company cooperate with the village officials with a view of making arrangements for the installation of a properly designed sewerage system; and that should active contamination at any time be found present in the water, the supply be sterilized with liquid chlorine, or a new and satisfactory source of supply developed.

BUFFALO

An investigation of the water supply of the city of Buffalo was made on March 30 and 31, 1920, by Mr. Earl Devendorf, assistant engineer of this Department.

Buffalo is a city of some 515,000 inhabitants, located in Erie county, at the eastern end of Lake Erie, and is a great railroad center, fourteen railroads entering the city. The geographical location of Buffalo being in the center of the Niagara Falls power district, together with its great transportation facilities, make it a very great industrial and manufacturing center. The city is served by a comprehensive sewer system, the sewage collected therein being discharged through three main outlets directly into Buffalo creek and Niagara river.

The city is operated under a commission form of government which was first inaugurated January 1, 1916. The public water supply is owned by the city and operated under the Board of Public Works, of which Mr. Arthur Kreinheder is Commissioner, with Mr. George C. Andrews as Commissioner of Water. The Water Department is a large organization with various divisions for official supervision, operation and maintenance, purification, pumpage, and a recently organized pitometer division, the work of which consists of making surveys for the elimination of water waste. The supply is derived from Lake Erie, from which the water is pumped, after chlorination, through two pumping stations into the distribution system.

When the city took possession of the supply in 1868, the water was pumped from the Niagara river, the intake being located on Bird Island pier. The Niagara river intake pier, located opposite the Massachusetts avenue pumping station, was first built in 1870, enlarged in 1895, and reconstructed in 1906. After a severe typhoid outbreak which occurred in 1894, the source of which was traced to the public water supply obtained through the auxiliary intake located on Bird Island pier, this intake was permanently closed. In 1907 construction was started on the Emerald Channel intake, and tunnels and a new pumping station now known as the Porter Avenue pumping station. The work was completed and the new station started in operation in 1914.

The Massachusetts Avenue intake extends into Niagara river about 1,000 feet from shore, and is located in approximately 16 feet of water. The river current at this point varies from 8 to 10 miles per hour. This supply is often contaminated at times of flood, when the polluted waters of Buffalo harbor would be carried out into the river current at this point.

The Emerald Channel intake is circular in form having an inside diameter of 70 feet, the superstructure of which consists of concrete walls 20 feet in thickness encased with ⅜-inch steel shell plates inside and out. On this superstructure a circular steel building is located and serves to house the chlorination apparatus, generator, boilers, and pumping equipment used in operation of the chlorination apparatus. The water from the lake enters through 12 ports 6 feet by 6 feet in size. each provided with gates 6 feet above the bottom of the lake and 20 feet below the ordinary lake level. A 12-foot shaft located in the center of the structure carries water to the 12-foot arched intake conduit which is driven through limestone rock and has an 18-inch concrete lining. Water enters this shaft from the interior of the intake through four gates each 5¼ feet by 6 feet in size. This conduit carries the water to the shore where it is intercepted by a second shaft, from which part of the water flows to the Porter Avenue pumping station and the rest is carried by a 9-foot tunnel to the Massachusetts Avenue pumping station. Since the completion of the Emerald Channel intake. the use of the old or Massachusetts Avenue intake has been abandoned and it has simply been held in reserve.

The Massachusetts Avenue pumping station originally housed six 30,000,000-gallon vertical. triple expansion steam pumps, and two 25,000,000-gallon electric pumps. The electric pumps have been removed, and at present only one or two steam pumps are in use. Steam is generated by 16 horizontal tubular boilers of 300-h.p. each, and 4 water tube boilers of 600-h.p. each.

The Porter Avenue pumping station, which was put in operation in 1914. supplies most of the water used in the city at the present time. This station is one of the largest of its kind in the world, and houses five 30,000,000-gallon vertical triple expansion steam pumps, and space is provided for three additional pumps. Steam is furnished by eight 750-h.p. sectional water tube boilers, and space is provided for the installation of eight additional boilers. A meter room is provided in which there are five 48-inch Venturi meters, one for each pump. A valve system, in which all valves are hydraulically operated, is also installed in the station, and so arranged that any pump can be put on either service a few moments after notice.

Water is distributed by pumping through two zones, the high pressure and the low pressure zone. The pressure at the station on the high service ranges from 80 to 90 pounds per square inch, and that on the low service line from 42 to 50 pounds per square inch. The high pressure system in general takes care of the newer section of the city, while the low pressure line supplies the older section. The daily water consumption during 1919 averaged 135,577,694 gallons or 263 gallons per capita, of which it is estimated that 98 gallons were used for commercial purposes. The distribution system consists of 620 miles of mains ranging in size from 1½ to 60 inches in diameter. There are 93,041 service taps, of which only 7.6 per cent are metered.

The Kensington water tower is located in the northeastern section of the city, and consists of a steel tank 40 feet in diameter and 85 feet in height, surrounded by an ornamental stone and brick tower. When filled to a depth of 75 feet the tower holds 705,000 gallons, and serves as a pressure equalizer on the high pressure service system. Prospect reservoir, located in the eastern part of the city, covers an area of 20 acres. When filled to a depth of 30 feet the reservoir holds 116,300,000 gallons, and serves as a distributing and pressure equalizing reservoir on the low service system.

Lake Erie, from which the public water supply of Buffalo is derived, is the fourth in the chain of Great Lakes and has a length of about 250 miles and an average width of about 45 miles. It has an average depth of 63 feet and an area of 10,000 square miles, with a total capacity of 17,500,000 million cubic feet which gives a storage capacity of about 1,000 days, assuming the average flow over Niagara Falls as 220,000 c.f.s. The total drainage area of Lake Erie is 24,000 square miles exclusive of the water surface of the lake. The axis of the lake extends in an east-northeast and west-southwest direction for its entire length.

Although there is a general drift eastward toward Buffalo, the water of Lake Erie does not move from one end to the other. This subject has been studied by the United States Weather Bureau, and their reports show the prevailing wind to be westerly. In addition to the wind, temperature changes influence the water movement in the lake as well as the discharge of streams entering the lake. The prevailing winds cause oscillations in the lake level, having an amplitude at times, at Buffalo, as great as 7 feet or more.

The waters of Lake Erie receive the sewage from a very large population existing on its watershed. It may be considered, however, that the streams entering the lake some distance above Buffalo do not appreciably affect the quality of the lake water, and it will be necessary therefore to consider only the nearby sources. These consist of the discharge of Buffalo creek, carrying the sewage of a portion of the city of Buffalo, and the flow of which at flood times amounts to nearly one-tenth of the flow of the Niagara river, together with the discharge of several other creeks discharging into Lake Erie along the south shore. The extent of diffusion of the waters of these streams and the direction which the diluted sewage takes depend upon so many factors that are indefinite that theoretical calculations upon the subject give but little satisfaction. Continued analyses, covering long periods of observation under many varying conditions, have shown that the water supply is fairly well protected against pollution by factors naturally tending to effect its purification consisting of dilution. sedimentation, sunlight aeration, and the natural death of the pathogenic organisms.

While extensive studies of the lake currents in the eastern end of Lake Erie have indicated that the water of streams carrying pollution and entering Buffalo harbor are deflected from the waterworks intake, the effects of floods and wind storms are unknown, and under these conditions water may be deflected to the waterworks intake. From data obtained during a study made by this Department in the month of March, 1920, for the purpose of determining the cause of excessive turbidity in the Niagara river water at certain times, it was shown that the lake water, which is usually clear and unaffected by the sewage from the city of Buffalo and Buffalo creek, is under the unusual conditions of heavy runoff or flood affected by these discharges. Under these conditions the effective operation of the chlorination apparatus is the only source of protection for safety of the public water supply.

The city has no control over the steamers, scows, and fishing boats which, in carrying many thousands of people, pass near the waterworks intake and discharge the sewage from the boats without any treatment or restriction as to point of discharge. In addition, hundreds of fishermen go out on the ice during the winter, and the excreta from these people gives rise to another very great menace to the purity of the public water supply. The city must guard against these accidental sources of pollution by efficient operation of the chlorination apparatus.

The chlorination of the public water supply at Buffalo was first started in 1914, when a contract for the installation of such a plant was let to the Electro-Bleaching Gas Company of New York, and the plant completed and started in operation during August of that year. This chlorination plant is located at the Emerald Channel inlet pier, where it was in operation until the year 1919, when a new chlorination plant, especially designed by the Wallace & Tiernan Company, was installed. This provided for the application of liquid chlorine by means of a dry feed type Wallace & Tiernan chlorinator to the condensing towers of the old Electro-Bleaching Gas Company's machine, through which water flows from an elevated tank to the bottom of a shaft in the center of the intake pier. Water is raised to the elevated tank by means of a steam pump.

At the time of the inspection the engineer was informed that, due to trouble experienced in the operation of the chlorination plant through frequent stoppages of the overflow of the condensing towers, it is proposed to provide an injector for applying the chlorine solution to the water at the bottom of the intake shaft. It is stated that the injector will be of a special type so designed as to operate on as low a pressure as 5 pounds. This installation, however, will be of a temporary nature only, and it is proposed finally to locate the chlorination plant on the shore near the Porter avenue pumping station. Here it is stated the plans call for the application of the chlorine to the intake tunnel at a point 100 feet from the shore shaft of the tunnel.

As there are three separate lines leading from the shore shaft to the two pumping stations, it is very important that the application of liquid chlorine to the public water supply be evenly distributed. In this connection it should be pointed out that it is extremely difficult to distribute evenly the chlorine in a tunnel of this description unless a series of pipes could be installed across the diameter of the tunnel. This, however, cannot be done here as it is stated at times considerable anchor ice and slush enters the intake well and may possibly enter the tunnel leading to the pumping stations. The difficulty to be guarded against will be the accumulation of gas or chlorine solution at the top of the tunnel, where it will be slowly carried along to the shaft without becoming thoroughly mixed with the flow of water in the tunnel. It would therefore appear more practicable and afford a greater insurance of the even application of liquid chlorine to the public supply to arrange for its being applied in the separate intakes leading from the shore shaft. This matter, however. before being finally passed upon should receive further study, and if possible experiments should be carried on to show the actual movement of distribution in the pipe line.

The rate of application of chlorine to the public water supply ranges from 0.6 pound per million gallons during the winter when clear water is obtained, to 1.9 pounds per million gallons at times of wind storms when the water becomes quite turbid. The amount is regulated by a chemist who makes daily bacterial analyses as well as occasional chemical analyses.

From a study of the following table the effect of the chlorination of the public water supply upon the typhoid death rate beginning with the year 1915, when the chlorination plant was installed, can be easily seen. This amounts to a reduction from a death rate per 100,000 of 20.2 in 1910 to 6.6 in 1919.

Typhoid Death Rate in Buffalo for Ten Years Past

Year	*Population*	*Deaths from Typhoid*	*Rate per 100,000*
1910	423,715	86	20.2
1911	435,315	108	24.8
1912	444,915	50	11.2
1913	446,869	68	15.2
1914	454,112	72	15.8
1915	486,000	46	9.5
1916	495,000	51	10.8
1917	505,000	48	9.5
1918	505,000	37	7.3
1919	515,000	34	6.6

The prevailing winds at Buffalo come from the west and southwest and it is after the occurrence of a storm from this quarter that the bottom in the shallow harbor is stirred up, causing the public water supply to become turbid. During the year this condition is said to prevail from 10 to 15 per cent of the time. The sediment is quite heavy and settles rapidly so that after a storm has subsided the water quickly clears. During these storm periods, however, the water is decidedly unsightly and objectionable. This condition can be remedied only by filtration of the public supply.

In a report presented to the city council on February 4, 1920, by the commissioner of water this matter was discussed, and it was requested that the council authorize the commissioner to employ the aid of an expert to study this matter. The city should, therefore, consider at as early a date as possible the matter of the establishment of a filtration plant for treating the public water supply. In this connection studies should be made of the most desirable type of filter plant for Buffalo's particular needs, the most desirable site for the plant, together with a study of the conditions and changes of the lake water at Buffalo over an extended period of time.

At the time of the inspection samples of water were collected and sent to the Division of Laboratories and Research for analyses, the results of which are as follows:

Color	tr.	Oxygen consumed	1.2
Odor, hot	lv.	Chlorine	10.
Odor, cold	lv.	Hardness, total	93.8
Turbidity	15	Alkalinity	89.
Ammonia, free	.008	Bacteria per c.c. 20°C. (liquefied)	.140
Ammonia, alb.	.068		
Nitrites	trace	B. coli type, 10 c.c.	0+3—
Nitrates	.100	B. coli type, 1 c.c.	0+3—
		B. coli type, 1/10 c.c.	0+3—

The results of these analyses show a moderately hard water having a slight color and some turbidity. The amount of nitrogen in its various forms indicates the presence of only moderate amounts of decomposing and decomposable organic matter. The oxygen consumed content is also moderate and the chlorine content is about normal for Lake Erie water. The results of the bacterial examination of the treated water show moderate total bacterial counts and the absence of organisms of the B. coli type. No sample of the raw water could be collected as the engineer did not make a trip to the intake pier at the time of the collection of samples, and therefore no data can be given on the matter of the effective operation of the chlorination plant.

As a result of this inspection it was recommended that the city authorities in charge of the public water supply continue their careful supervision of the public water supply in order that a supply of satisfactory sanitary quality may at all times be furnished to the consumers; that the waterworks officials continue the water waste survey and immediately install meters in those districts where the survey has shown the waste to be greatest in order to reduce to a minimum the amount of water being pumped; that a careful study be made of the proper location of the chlorination plant on shore in order that the chlorine may be effectively and uniformly applied; and that since at certain times of the year the public water supply is rendered so turbid due to storms that treatment by chlorination alone will not produce a satisfactory supply, the city authorities should consider the matter of the filtration of their water supply; and that due to the magnitude and complex nature of the undertaking, the city authorities in charge of the water supply engage a water supply expert to study the conditions and advise them with regard to the desirability as well as the economy and practicability of installing a filter plant for the treatment of their supply.

CADOSIA

An inspection of the water supply of the village of Cadosia was made by Mr. W. J. Erickson, engineering assistant in this Department, on May 20, 1920.

Cadosia, a village of about 100 population, is located in the southwestern part of Delaware county, at the junction of the Scranton division and main line of the New York, Ontario and Western railroad. There are two sources of water supply: one, a spring, supplies the drinking water for the depot and the water for filling the drinking water tanks on the trains; the other, a small stream, the water of which is used at the restaurant in the depot and for filling the locomotive water tanks.

The spring is developed by the construction of a small wooden basin from which water is conducted to the depot through a 1½-inch iron pipe. The watershed above the spring has an area of about one-half of a square mile and is entirely uninhabited and uncultivated.

The brook supply is developed by the construction of a small dam across a stream about two miles east of the northern end of the freight yard. A 6-inch castiron pipe conducts the water to the village.

At the time of the inspection samples from both the spring and brook supplies were taken and sent to the Division of Laboratories and Research for examination. The bacteriological examination of the sample from the spring supply showed a high count, but bacteria of the colon type were absent in all of the inoculations tested. The water from the brook supply showed a very high count, and colon bacilli were found present in all of the inoculations tested.

As a result of the inspection it was concluded that the spring supply, if properly protected, should yield a water of satisfactory sanitary quality, but that the brook supply is subject to incidental contamination and not safe for human consumption without treatment.

It was therefore recommended that the brook supply be maintained in a satisfactory sanitary condition at all times, and that the use of the brook supply for drinking and culinary purposes in the restaurant be discontinued.

The water of this supply is used by the New York, Ontario and Western railroad for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on October 18, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the spring supply were satisfactory, and that the results of the inspection and the analyses of the samples indicate that the water from the spring is of satisfactory quality for human consumption. A copy of the report accompanied this data. Based on this information the United States Public Health Service on November 11, 1920, issued a certificate permitting the use of the water for drinking and culinary purposes in interstate traffic.

CALLICOON

A reinspection of the water supply of the village of Callicoon was made on June 15, 1920, by Mr. W. J. Erickson, engineering assistant. A previous inspection of this supply was made by this Department in 1916, the report upon which is published in the Annual Report of the Department for that year.

Callicoon is an unincorporated village of about 500 inhabitants, and is located on the Delaware river in the town of Delaware, Sullivan county, N. Y. It is on the main line of the Erie railroad about 48 miles northwest of Port Jervis. Approximately 90 per cent of the inhabitants are served with water from the public supply, which is owned and controlled by the Callicoon Water Company.

The supply is derived from two springs located northeast of the village and is conducted by gravity to the distribution system on which there are about 80 service taps, 12 of which are metered. The excess over consumption is stored in an equalizing reservoir located north of the village, which maintains a pressure of about 70 pounds per square inch in the main parts of the village.

The farther spring, known as the Bleckley spring, is located in the side of a rocky cliff about three-quarters of a mile northeast of the village. The supply issues from crevices in the bluestone formation. It has been developed by the construction of a masonry collecting chamber which is protected by a substantial wooden cover. The spring is not fenced or ditched, but the contour of the land above is such that the surface wash is conducted away from the spring. A small depression leading to a natural watercourse is located above the spring and it is possible that this may be the source of the supply. This area is not cultivated or used in any way. The area below, however, is used for pasturage. From the spring the water is conducted through a castiron pipe to a small concrete collecting basin located in the center of the field. The basin is enclosed by a wire fence 3 feet from it, and is provided with a substantial wooden hip roof.

The Anderson spring is located below the Bleckley spring. It, too, issues from the bluestone formation in the side of a wooded hill. It has been developed by the construction of a concrete wall and is protected by a wooden roof. The area around and above the spring is wooded and heavily covered with underbrush. The fence mentioned in the previous report is in bad repair, but the conditions are such that it is very difficult for cows or other animals to get near the spring. The third spring has been permanently abandoned.

The equalizing reservoir, which is about 60 feet square and about 15 feet deep, is of concrete construction and is provided with a substantial wooden hip roof. The concrete walls extend from 6 to 18 inches above the ground surface. Ditches conduct the surface wash away from the reservoir.

An auxiliary supply is obtained by pumping from a driven well located in the northwestern part of the village near the Erie railroad. It is driven through 6 feet of earth, sand, and gravel, 50 feet of clay or hardpan, 100 feet of blue sandstone, 15 feet of brown sandstone, 80 feet of red water bearing gravel, and 6 feet of gray sandstone, or about 256 feet total depth. The well is cased with an 8-inch casing for a distance of 63 feet or into the blue sandstone. Water rises to about 20 feet from the top of the well. A 4-inch suction extends to the bottom of the well. The pump house is located above the well.

About 100 feet from the well is a sewage disposal plant which serves some 50 people. It consists of a settling tank and a gravel filter. The effluent from the settling tank flows to the filter and leaches through the stone or gravelly soil into a ditch which discharges into a small brook flowing through a culvert under the railroad. The disposal plant appeared to be working efficiently at the time of the inspection. No plans of this sewage disposal plant have been submitted to or approved by this Department as required by law. The privy located 150 feet above the well has been cleaned since the previous inspection and appeared to be in a satisfactory sanitary condition. A number of houses are located above the well at distances from it ranging between 500 and 1,000 feet.

The land in the vicinity of the well is low, and it seems possible that at times of flood, pollution may be carried to the well from the disposal plant and from the stream flowing by the pump house. Judging from the general construction it does not seem probable that pollution enters the well under normal conditions. The location of the disposal plant is, however, a serious menace to the well supply.

The brook supply has been permanently abandoned.

At the time of the inspection samples were taken of the tap water and sent to the Division of Laboratories and Research for analyses, the results of which are given below. As the well supply was not in use, it was impossible to take a sample from this source.

Color	0	Oxygen consumed	.5
Odor, hot	none	Chlorine	1.0
Odor, cold	none	Hardness, total	22.1
Turbidity	0	Alkalinity	14.
Ammonia, free	.002	Bacteria per c. c.	50,000
Ammonia, alb.	.002	B. coli type, 10 c. c.	.3+0—
Nitrites	absent	B. coli type, 1 c. c.	1+2—
Nitrates	.200	B. coli type, 1/10 c. c.	0+3—

These results show a water that is clear, colorless, and soft. The figures for nitrogen compounds in their various forms are low, except that for nitrates which is high, denoting that the supply has probably at some previous time received some organic pollution which has been rendered inert by passing through the ground. The high total count is probably due to some extent to the fact that the sample was delayed in transit. The presence, however, of organisms of the B. coli type in one of the three 1 c. c. samples denoted the presence of considerable active contamination. As rains had fallen steadily previous to the inspection, this may be due to the infiltration of surface water from the pasture lands around the spring.

In view of the above facts it was recommended that the Bleckley spring be fenced to exclude cattle from the immediate vicinity, and that proper precautions be taken at all times to protect the springs from pollution; that the present sewage disposal plant in the vicinity of the well be abandoned and another provided, plans for which shall be approved by this Department as required by law; and that all privies within 500 feet of the well be provided with water-tight containers and maintained in a satisfactory sanitary condition.

CANTON

A reinspection of the public water supply of the village of Canton was made by Mr. Earl Devendorf, assistant engineer in this Department, on July 8, 1920, a previous inspection having been made on June 29, 1919.

Canton is located on the DeGrasse river, in the central part of St. Lawrence county, about 60 miles north of the city of Watertown. The population is approximately 2,760, exclusive of the students, officers, and employees of the St. Lawrence University and the State Agricultural College, who number about 600.

The village is provided with a sanitary sewer system which discharges into the DeGrasse river a short distance below the pumping station formerly used to pump water from the river for the public water supply. This source of supply has not been used since January 1, 1919.

The present water supply is derived from seven springs connected to form two groups, one consisting of the Barrett, O'Brien, Allen, Matthews, and Dinsdale springs, and the other the Barriger and Coller springs. All the water from the springs is treated with liquid chlorine applied at the rate of 0.4 parts per million.

At the time of the inspection the conditions on the watersheds were practically the same as those described in the former report. The buildings at the O'Brien and Allen springs have, however, been removed, and the village now owns and has just completed the erection of fences around the watersheds of all the springs, with the exception of a portion of the watershed of the Coller spring which has not yet been purchased. This area covers about 1½ acres and consists of a wooded pasture lot. The major portion of the watershed of this spring consists of muck land through which collecting channels have been dug to convey the water to the intake reservoir. The depth of the muck is said to vary from 3 to 6 feet. It is the intention of the village authorities to remove this muck, and for that purpose the village has purchased two Kopple cars and some 400 feet of industrial track. The watershed of the Barrett spring will at times receive the road wash of the little used dirt road. In the reservoirs of the Matthews, Coller, Dinsdale, and Barriger springs some algae growths were present. These growths are kept down, however, by the frequent use of copper sulphate. In this connection it would seem desirable that consideration should be given to covering these reservoirs to prevent growths of algae.

The village authorities have applied to this Department for the enactment of rules to protect the sanitary quality of their supply in accordance with the recommendations of the Conservation Commission when the permit was granted for the construction of the present supply.

The pumping station formerly used for pumping water from the DeGrasse river was at the time of the inspection still connected to the distribution system, and is separated from it by means of an 8-inch gate valve, the village authorities being reluctant to abandon the pumping station entirely because of the ever-present possibility of a break occurring in the main supplying the village when it would become necessary to provide an additional supply. If this pumping station is retained, the village authorities should remove the bonnets and gates of the two 8-inch gate valves on the discharge of the pumps, or take some other similar precaution to make it impossible for an unauthorized person to operate the pumping station and pump the raw water from the DeGrasse river into the village distribution system. The containers holding hypochlorite of lime to be used in the temporary sterilization plant provided at the pumping station had all broken open at the time of the inspection. In this connection it would be well to have a cylinder of chlorine kept constantly at the pumping station in order that the supply may be chlorinated if it should become necessary to use this source of supply.

As a result of the investigation the following conclusions were drawn:

1. That the previous recommendations of this Department have been carried out with the exception of the removal of the cross connection between the DeGrasse river pumping station and the village distribution system.
2. That the analyses of samples of water from the east line of springs indicate that these springs are subject to some contamination, probably of animal rather than human origin.
3. That, as is true of all surface supplies, the supply is subject to the local or chance contamination by trespassers upon the watershed.
4. That the Little river supply is subject to contamination by surface wash.

It was therefore recommended:

1. That the village authorities immediately sever the cross connection between the DeGrasse river pumping station and the village distribution system by removing the bonnets of the valves on the discharge lines of the pumps as pointed out above, or by removing a section of pipe from the discharge line.
2. That provision be made to treat the DeGrasse river supply with liquid chlorine before pumping into the village distribution system should occasion for its use ever arise.
3. That the village authorities purchase and fence the remaining portion of the watershed of the Coller spring.
4. That in view of the results of the recent examination the village authorities continue to operate the chlorination apparatus and treat the supply with adequate amounts of chlorine at all times.

5. That the Little river supply should in no case be used as an auxiliary supply without sterilization by means of liquid chlorine.

6. That as previously recommended the village authorities frequently flush all the dead ends of the distribution system.

7. That the village authorities consider the matter of covering the reservoirs of the various springs in which algae growth occur.

8. That when the water rules recently prepared by this Department and now before the Board of Water Commissioners of the village for their consideration have been enacted, the village authorities post the watershed and make frequent inspections to discover and remove any sources of contamination which may be found to exist.

CASTLETON

A reinspection of the water supply of the village of Castleton was made on June 3, 1920, by Mr. W. J. Erickson, engineering assistant. Previous inspections of this supply were made by this Department in 1912, 1914, and 1917, the reports upon which are published in the Annual Reports of the Department for the respective years.

Castleton, which is an incorporated village of 1,583 inhabitants, is located on the east bank of the Hudson river, 9 miles south of Albany on the New York Central railroad. The supply is owned and operated by the village under the direction of the board of trustees. About 90 per cent of the population of the village uses the public water supply.

The supply is derived from Volkie kill by impounding the creek water in a storage reservoir located about 3 miles east of the village. The water is conducted by gravity through a distributing system consisting of about 11 miles of mains varying from 6- to 16-inches in diameter on which there are some 300 service taps, all metered. No data is available as to the consumption.

A concrete intake chamber is located at the side of the stream about 500 feet above the reservoir. A small rock dam serves to divert the water into the intake chamber. The main stream flows in its natural channel around the reservoir and carries the heavier sediment with it in times of heavy runoff. From the intake chamber the water flows to a small screen chamber 10 feet distant, and from there to either the reservoir or to a small storage chamber located below the reservoir.

The reservoir is about 2 acres in area and is quite shallow. Considerable trouble is experienced from algae for which the water is treated with copper sulphate. The reservoir was last cleaned three years ago. It is protected from surface wash by a 3-foot embankment.

The small storage chamber was constructed three years ago below the reservoir. It is formed by subdividing a concrete reservoir by a concrete wall so that a smaller reservoir is formed, 3 by 17 feet in plan and 12 feet deep, having a capacity of about 3,240 gallons. In summer the supply is taken mainly from this reservoir.

The watershed has an area of about 6 square miles, most of which is cleared and used for farming and grazing. The total population is about 200, or 33 per square mile. The upper half of the watershed is rather hilly while the area nearer the reservoir is more level. The soil is sandy gravel over shale and slate.

The sanitary conditions on the watershed are about the same as described in the previous report. Several highways traverse it and there are about 40 houses on it most of which are located well back from the stream and its tributaries. The Shufelt place mentioned in the previous report is about a mile above the reservoir on the Albany Post road. The hog-pen mentioned as being located 15 feet from the stream has been cleaned and abandoned. There is, however, a barn close to the stream and a manure pile located about 30 feet from the stream. With this exception there seems to be no serious condition upon the watershed, although as it is a farming region there is considerable wash from farm lands at times of heavy rain.

The supply has been depreciated as to its aesthetic quality by bad tastes and odors. Considerable trouble has also been experienced by eels clogging the house pipes.

Samples of the village supply were collected at a tap in the village and sent to the Division of Laboratories and Research for analyses. The results of these analyses are as follows:

Color	trace	Oxygen consumed	1.4
Odor, hot	lv	Chlorine	1.6
Odor, cold	lv	Hardness, total	122.8
Turbidity	0	Alkalinity	104
Ammonia, free	.002	Bacteria per c.c.	60
Ammonia, alb.	.068	B. coli type, 1/10 c.c.	3+0—
Nitrites	.001	B. coli type, 1 c.c	2+1—
Nitrates	.300	B. coli type, 10 c.c	0+3—

The analyses show a water that is hard and at times very turbid and colored. The figures for ammonia compounds are fairly high, especially those for albuminoid ammonia, denoting the presence of some organic pollution probably largely of vegetable origin. The total counts are moderately high and the presence of B. coli in almost all 10 c.c. and 1 c. c. volumes, and occasionally in 1/10 c.c. volumes, indicates the presence of considerable active contamination of human or animal origin.

In view of these facts it was concluded that the recommendations of the previous report of this Department have not been fully carried out, and that the supply is subject to incidental contamination and pollution by surface wash and is not suitable for human consumption without proper treatment.

It was therefore recommended that the village authorities carry out the recommendations of the previous report of this Department regarding the installation of a filtration and sterilization plant.

CENTRAL ISLIP (State Hospital)

Plans for proposed extensions to the water distribution system of Central Islip State Hospital, Central Islip, N. Y., to serve additional quarters for acute patients, were submitted to this Department for approval by the State Architect, April 29, 1920, and after careful consideration by the Engineering Division were approved on May 3, 1920.

CHATHAM

A reinspection of the water supply of the village of Chatham was made on January 9, 1920, by Mr. Earl Devendorf, assistant engineer. Previous inspections of this supply were made by this Department in 1911 and 1918, the reports upon which are published in the Annual Reports of the Department for the respective years.

Chatham is an incorporated village of about 2,200 inhabitants, located in the north central portion of Columbia county, on the Stoney kill, a tributary to Kinderhook creek, 22 miles southeast of Albany.

The public water supply is owned by the village and operated under the direction of the board of trustees. There are two sources of supply, namely the Blinn and Palmer well supplies. The Blinn supply consists of 20 driven wells located about 1 mile east of the village. The Palmer supply, which consists of a dug well, is located below the village level and a short distance from Smith pond. From these wells the water is pumped to the village distribution system, and the excess over consumption goes to a reservoir 1 acre in area located on a hill about ¼ of a mile north of the village and having a capacity of 4,000,000 gallons. The consumption varies from 300,000 to 350,000 gallons per day, of which consumers use 150,000 gallons per day, giving an average domestic consumption of approximately 70 gallons per capita per day.

At the time of the present inspection the Palmer well was in use and had been used continuously since July 16, 1919, at which time the contract with the power company for the operation of the pumping equipment located at the Blinn pumping station expired.

It has been planned to locate a new laundry about 300 feet north of the Palmer pumping station and near a large gravel pit located not far from the well. The engineer was informed that the wastes were to be discharged into the gravel pit, which at times when the pump is shut down is said to fill with water, indicating that the ground water at this gravel pit is tributary to the well. Under such conditions the laundry should not be located as proposed but at a point remote from the sources of the public water supply, and the wastes properly disposed of so as not to affect the ground water tributary to the water supply of the village.

In other respects the conditions of both pumping stations and the supply were approximately the same as described in the former report.

In view of these facts it was recommended that the village authorities continue as in the past to keep the grounds surrounding the wells in a clean and sanitary condition; to have frequent analyses made in order that the occurrence of any active contamination of the water supply may be discovered and eliminated; that another location be secured for the laundry other than that proposed near the Palmer well, care being taken so to locate the laundry and so to take care of the wastes discharged that there will be no opportunity for pollution of the ground water sources of the village water supply; and that, as previously recommended, a system of sanitary sewers be installed as soon as possible.

CINCINNATUS

A reinspection of the water supply of the village of Cincinnatus was made on June 4, 1920, by Mr. A. I. Howd, assistant engineer. Previous inspections of this supply were made by this Department in 1912, 1915, and 1918, the reports upon which are published in the Annual Reports of the Department for the respective years.

Cincinnatus is an unincorporated village located in the southeastern part of Cortland county, and has a population of about 500 people. It is on the Otselic river, and is the eastern terminus of the Cortland branch of the Delaware, Lackawanna and Western railroad, about 19 miles east of Cortland. The waterworks are in charge of a board of water commissioners.

The water supply is obtained from springs located about 2 miles southwest of the village, and a reserve supply is available from a well at the plant of the Reid Ice Cream Co. The water from the various springs is collected in a concrete basin from which it flows by gravity into the distribution system, the surplus over consumption going into a concrete reservoir 50 feet in diameter and 12 deep having a capacity of about 175,000 gallons. There are about 4½ miles of mains ranging from 3 to 8 inches in diameter and about 100 service taps of which approximately 95 per cent are metered. The water is not subjected to purification.

The recent inspection disclosed the fact that conditions remain practically the same as at the time of the previous inspection. No action has been taken by the authorities in charge of the water supply on our recommendations on the following matters: The construction of trenches above the springs, the raising of the masonry of the springs and catch-basins, and the fencing of an area around the springs to prohibit trespassing. The storage reservoir has not been covered to exclude sunlight and thus prevent algae growths. The cultivation of land above the springs, however, has been abandoned.

ranges from 80 to 90 pounds per square inch, and that on the low service line from 42 to 50 pounds per square inch. The high pressure system in general takes care of the newer section of the city, while the low pressure line supplies the older section. The daily water consumption during 1919 averaged 135,577,694 gallons or 263 gallons per capita, of which it is estimated that 98 gallons were used for commercial purposes. The distribution system consists of 620 miles of mains ranging in size from 1½ to 60 inches in diameter. There are 93,041 service taps, of which only 7.6 per cent are metered.

The Kensington water tower is located in the northeastern section of the city, and consists of a steel tank 40 feet in diameter and 85 feet in height, surrounded by an ornamental stone and brick tower. When filled to a depth of 75 feet the tower holds 705,000 gallons, and serves as a pressure equalizer on the high pressure service system. Prospect reservoir, located in the eastern part of the city, covers an area of 20 acres. When filled to a depth of 30 feet the reservoir holds 116,300,000 gallons, and serves as a distributing and pressure equalizing reservoir on the low service system.

Lake Erie, from which the public water supply of Buffalo is derived, is the fourth in the chain of Great Lakes and has a length of about 250 miles and an average width of about 45 miles. It has an average depth of 63 feet and an area of 10,000 square miles, with a total capacity of 17,500,000 million cubic feet which gives a storage capacity of about 1,000 days, assuming the average flow over Niagara Falls as 220,000 c.f.s. The total drainage area of Lake Erie is 24,000 square miles exclusive of the water surface of the lake. The axis of the lake extends in an east-northeast and west-southwest direction for its entire length.

Although there is a general drift eastward toward Buffalo, the water of Lake Erie does not move from one end to the other. This subject has been studied by the United States Weather Bureau, and their reports show the prevailing wind to be westerly. In addition to the wind, temperature changes influence the water movement in the lake as well as the discharge of streams entering the lake. The prevailing winds cause oscillations in the lake level, having an amplitude at times, at Buffalo, as great as 7 feet or more.

The waters of Lake Erie receive the sewage from a very large population existing on its watershed. It may be considered, however, that the streams entering the lake some distance above Buffalo do not appreciably affect the quality of the lake water, and it will be necessary therefore to consider only the nearby sources. These consist of the discharge of Buffalo creek, carrying the sewage of a portion of the city of Buffalo, and the flow of which at flood times amounts to nearly one-tenth of the flow of the Niagara river, together with the discharge of several other creeks discharging into Lake Erie along the south shore. The extent of diffusion of the waters of these streams and the direction which the diluted sewage takes depend upon so many factors that are indefinite that theoretical calculations upon the subject give but little satisfaction. Continued analyses, covering long periods of observation under many varying conditions, have shown that the water supply is fairly well protected against pollution by factors naturally tending to effect its purification consisting of dilution, sedimentation, sunlight aeration, and the natural death of the pathogenic organisms.

While extensive studies of the lake currents in the eastern end of Lake Erie have indicated that the water of streams carrying pollution and entering Buffalo harbor are deflected from the waterworks intake, the effects of floods and wind storms are unknown, and under these conditions water may be deflected to the waterworks intake. From data obtained during a study made by this Department in the month of March, 1920, for the purpose of determining the cause of excessive turbidity in the Niagara river water at certain times, it was shown that the lake water, which is usually clear and unaffected by the sewage from the city of Buffalo and Buffalo creek, is under the unusual conditions of heavy runoff or flood affected by these discharges. Under these conditions the effective operation of the chlorination apparatus is the only source of protection for safety of the public water supply.

The city has no control over the steamers, scows, and fishing boats which, in carrying many thousands of people, pass near the waterworks intake and discharge the sewage from the boats without any treatment or restriction as to point of discharge. In addition, hundreds of fishermen go out on the ice during the winter, and the excreta from these people gives rise to another very great menace to the purity of the public water supply. The city must guard against these accidental sources of pollution by efficient operation of the chlorination apparatus.

The chlorination of the public water supply at Buffalo was first started in 1914, when a contract for the installation of such a plant was let to the Electro-Bleaching Gas Company of New York, and the plant completed and started in operation during August of that year. This chlorination plant is located at the Emerald Channel inlet pier, where it was in operation until the year 1919, when a new chlorination plant, especially designed by the Wallace & Tiernan Company, was installed. This provided for the application of liquid chlorine by means of a dry feed type Wallace & Tiernan chlorinator to the condensing towers of the old Electro-Bleaching Gas Company's machine, through which water flows from an elevated tank to the bottom of a shaft in the center of the intake pier. Water is raised to the elevated tank by means of a steam pump.

At the time of the inspection the engineer was informed that, due to trouble experienced in the operation of the chlorination plant through frequent stoppages of the overflow of the condensing towers, it is proposed to provide an injector for applying the chlorine solution to the water at the bottom of the intake shaft. It is stated that the injector will be of a special type so designed as to operate on as low a pressure as 5 pounds. This installation, however, will be of a temporary nature only, and it is proposed finally to locate the chlorination plant on the shore near the Porter avenue pumping station. Here it is stated the plans call for the application of the chlorine to the intake tunnel at a point 100 feet from the shore shaft of the tunnel.

As there are three separate lines leading from the shore shaft to the two pumping stations, it is very important that the application of liquid chlorine to the public water supply be evenly distributed. In this connection it should be pointed out that it is extremely difficult to distribute evenly the chlorine in a tunnel of this description unless a series of pipes could be installed across the diameter of the tunnel. This, however, cannot be done here as it is stated at times considerable anchor ice and slush enters the intake well and may possibly enter the tunnel leading to the pumping stations. The difficulty to be guarded against will be the accumulation of gas or chlorine solution at the top of the tunnel, where it will be slowly carried along to the shaft without becoming thoroughly mixed with the flow of water in the tunnel. It would therefore appear more practicable and afford a greater insurance of the even application of liquid chlorine to the public supply to arrange for its being applied in the separate intakes leading from the shore shaft. This matter, however. before being finally passed upon should receive further study, and if possible experiments should be carried on to show the actual movement of distribution in the pipe line.

The rate of application of chlorine to the public water supply ranges from 0.6 pound per million gallons during the winter when clear water is obtained, to 1.9 pounds per million gallons at times of wind storms when the water becomes quite turbid. The amount is regulated by a chemist who makes daily bacterial analyses as well as occasional chemical analyses.

From a study of the following table the effect of the chlorination of the public water supply upon the typhoid death rate beginning with the year 1915, when the chlorination plant was installed, can be easily seen. This amounts to a reduction from a death rate per 100,000 of 20.2 in 1910 to 6.6 in 1919.

Typhoid Death Rate in Buffalo for Ten Years Past

Year	*Population*	*Deaths from Typhoid*	*Rate per 100,000*
1910	423,715	86	20.2
1911	435,315	108	24.8
1912	444,915	50	11.2
1913	446,869	68	15.2
1914	454,112	72	15.8
1915	486,000	46	9.5
1916	495,000	51	10.8
1917	505,000	48	9.5
1918	505,000	37	7.3
1919	515,000	34	6.6

The prevailing winds at Buffalo come from the west and southwest and it is after the occurrence of a storm from this quarter that the bottom in the shallow harbor is stirred up, causing the public water supply to become turbid. During the year this condition is said to prevail from 10 to 15 per cent of the time. The sediment is quite heavy and settles rapidly so that after a storm has subsided the water quickly clears. During these storm periods, however, the water is decidedly unsightly and objectionable. This condition can be remedied only by filtration of the public supply.

In a report presented to the city council on February 4, 1920, by the commissioner of water this matter was discussed, and it was requested that the council authorize the commissioner to employ the aid of an expert to study this matter. The city should, therefore, consider at as early a date as possible the matter of the establishment of a filtration plant for treating the public water supply. In this connection studies should be made of the most desirable type of filter plant for Buffalo's particular needs, the most desirable site for the plant, together with a study of the conditions and changes of the lake water at Buffalo over an extended period of time.

At the time of the inspection samples of water were collected and sent to the Division of Laboratories and Research for analyses, the results of which are as follows:

Color	tr.	Oxygen consumed	1.2
Odor, hot	lv.	Chlorine	10.
Odor, cold	lv.	Hardness, total	93.8
Turbidity	15	Alkalinity	89.
Ammonia, free	.008	Bacteria per c.c. 20°C (liquefied)	.140
Ammonia, alb.	.068		
Nitrites	trace	B. coli type, 10 c.c.	0+3—
Nitrates	.100	B. coli type, 1 c.c.	0+3—
		B. coli type, 1/10 c.c.	0+3—

The results of these analyses show a moderately hard water having a slight color and some turbidity. The amount of nitrogen in its various forms indicates the presence of only moderate amounts of decomposing and decomposable organic matter. The oxygen consumed content is also moderate and the chlorine content is about normal for Lake Erie water. The results of the bacterial examination of the treated water show moderate total bacterial counts and the absence of organisms of the B. coli type. No sample of the raw water could be collected as the engineer did not make a trip to the intake pier at the time of the collection of samples, and therefore no data can be given on the matter of the effective operation of the chlorination plant.

As a result of this inspection it was recommended that the city authorities in charge of the public water supply continue their careful supervision of the public water supply in order that a supply of satisfactory sanitary quality may at all times be furnished to the consumers; that the waterworks officials continue the water waste survey and immediately install meters in those districts where the survey has shown the waste to be greatest in order to reduce to a minimum the amount of water being pumped; that a careful study be made of the proper location of the chlorination plant on shore in order that the chlorine may be effectively and uniformly applied; and that since at certain times of the year the public water supply is rendered so turbid due to storms that treatment by chlorination alone will not produce a satisfactory supply, the city authorities should consider the matter of the filtration of their water supply; and that due to the magnitude and complex nature of the undertaking, the city authorities in charge of the water supply engage a water supply expert to study the conditions and advise them with regard to the desirability as well as the economy and practicability of installing a filter plant for the treatment of their supply.

CADOSIA

An inspection of the water supply of the village of Cadosia was made by Mr. W. J. Erickson, engineering assistant in this Department, on May 20, 1920.

Cadosia, a village of about 100 population, is located in the southwestern part of Delaware county, at the junction of the Scranton division and main line of the New York, Ontario and Western railroad. There are two sources of water supply: one, a spring, supplies the drinking water for the depot and the water for filling the drinking water tanks on the trains; the other, a small stream, the water of which is used at the restaurant in the depot and for filling the locomotive water tanks.

The spring is developed by the construction of a small wooden basin from which water is conducted to the depot through a 1½-inch iron pipe. The watershed above the spring has an area of about one-half of a square mile and is entirely uninhabited and uncultivated.

The brook supply is developed by the construction of a small dam across a stream about two miles east of the northern end of the freight yard. A 6-inch castiron pipe conducts the water to the village.

At the time of the inspection samples from both the spring and brook supplies were taken and sent to the Division of Laboratories and Research for examination. The bacteriological examination of the sample from the spring supply showed a high count, but bacteria of the colon type were absent in all of the inoculations tested. The water from the brook supply showed a very high count, and colon bacilli were found present in all of the inoculations tested.

As a result of the inspection it was concluded that the spring supply, if properly protected, should yield a water of satisfactory sanitary quality, but that the brook supply is subject to incidental contamination and not safe for human consumption without treatment.

It was therefore recommended that the brook supply be maintained in a satisfactory sanitary condition at all times, and that the use of the brook supply for drinking and culinary purposes in the restaurant be discontinued.

The water of this supply is used by the New York, Ontario and Western railroad for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on October 18, 1920, and included, in addition to the results of the analysis of a sample of the water the statement that at the time of the inspection the conditions surrounding the spring supply were satisfactory, and that the results of the inspection and the analyses of the samples indicate that the water from the spring is of satisfactory quality for human consumption. A copy of the report accompanied this data. Based on this information the United States Public Health Service on November 11, 1920, issued a certificate permitting the use of the water for drinking and culinary purposes in interstate traffic.

CALLICOON

A reinspection of the water supply of the village of Callicoon was made on June 15, 1920, by Mr. W. J. Erickson, engineering assistant. A previous inspection of this supply was made by this Department in 1916, the report upon which is published in the Annual Report of the Department for that year.

Callicoon is an unincorporated village of about 500 inhabitants, and is located on the Delaware river in the town of Delaware, Sullivan county, N. Y. It is on the main line of the Erie railroad about 48 miles northwest of Port Jervis. Approximately 90 per cent of the inhabitants are served with water from the public supply, which is owned and controlled by the Callicoon Water Company.

The supply is derived from two springs located northeast of the village and is conducted by gravity to the distribution system on which there are about 80 service taps, 12 of which are metered. The excess over consumption is stored in an equalizing reservoir located north of the village, which maintains a pressure of about 70 pounds per square inch in the main parts of the village.

The farther spring, known as the Bleckley spring, is located in the side of a rocky cliff about three-quarters of a mile northeast of the village. The supply issues from crevices in the bluestone formation. It has been developed by the construction of a masonry collecting chamber which is protected by a substantial wooden cover. The spring is not fenced or ditched, but the contour of the land above is such that the surface wash is conducted away from the spring. A small depression leading to a natural watercourse is located above the spring and it is possible that this may be the source of the supply. This area is not cultivated or used in any way. The area below, however, is used for pasturage. From the spring the water is conducted through a castiron pipe to a small concrete collecting basin located in the center of the field. The basin is enclosed by a wire fence 3 feet from it, and is provided with a substantial wooden hip roof.

The Anderson spring is located below the Bleckley spring. It, too, issues from the bluestone formation in the side of a wooded hill. It has been developed by the construction of a concrete wall and is protected by a wooden roof. The area around and above the spring is wooded and heavily covered with underbrush. The fence mentioned in the previous report is in bad repair, but the conditions are such that it is very difficult for cows or other animals to get near the spring. The third spring has been permanently abandoned.

The equalizing reservoir, which is about 60 feet square and about 15 feet deep, is of concrete construction and is provided with a substantial wooden hip roof. The concrete walls extend from 6 to 18 inches above the ground surface. Ditches conduct the surface wash away from the reservoir.

An auxiliary supply is obtained by pumping from a driven well located in the northwestern part of the village near the Erie railroad. It is driven through 6 feet of earth, sand, and gravel, 50 feet of clay or hardpan, 100 feet of blue sandstone, 15 feet of brown sandstone, 80 feet of red water bearing gravel, and 6 feet of gray sandstone, or about 256 feet total depth. The well is cased with an 8-inch casing for a distance of 63 feet or into the blue sandstone. Water rises to about 20 feet from the top of the well. A 4-inch suction extends to the bottom of the well. The pump house is located above the well.

About 100 feet from the well is a sewage disposal plant which serves some 50 people. It consists of a settling tank and a gravel filter. The effluent from the settling tank flows to the filter and leaches through the stone or gravelly soil into a ditch which discharges into a small brook flowing through a culvert under the railroad. The disposal plant appeared to be working efficiently at the time of the inspection. No plans of this sewage disposal plant have been submitted to or approved by this Department as required by law. The privy located 150 feet above the well has been cleaned since the previous inspection and appeared to be in a satisfactory sanitary condition. A number of houses are located above the well at distances from it ranging between 500 and 1,000 feet.

The land in the vicinity of the well is low, and it seems possible that at times of flood, pollution may be carried to the well from the disposal plant and from the stream flowing by the pump house. Judging from the general construction it does not seem probable that pollution enters the well under normal conditions. The location of the disposal plant is, however, a serious menace to the well supply.

The brook supply has been permanently abandoned.

At the time of the inspection samples were taken of the tap water and sent to the Division of Laboratories and Research for analyses, the results of which are given below. As the well supply was not in use, it was impossible to take a sample from this source.

Color	0	Oxygen consumed	.5
Odor, hot	none	Chlorine	1.0
Odor, cold	none	Hardness, total	22.1
Turbidity	0	Alkalinity	14.
Ammonia, free	.002	Bacteria per c. c.	50,000
Ammonia, alb.	.002	B. coli type, 10 c. c.	3+0—
Nitrites	absent	B. coli type, 1 c. c.	1+2—
Nitrates	.200	B. coli type, 1/10 c. c.	0+3—

These results show a water that is clear, colorless, and soft. The figures for nitrogen compounds in their various forms are low, except that for nitrates which is high, denoting that the supply has probably at some previous time received some organic pollution which has been rendered inert by passing through the ground. The high total count is probably due to some extent to the fact that the sample was delayed in transit. The presence, however, of organisms of the B. coli type in one of the three 1 c. c. samples denoted the presence of considerable active contamination. As rains had fallen steadily previous to the inspection, this may be due to the infiltration of surface water from the pasture lands around the spring.

In view of the above facts it was recommended that the Bleckley spring be fenced to exclude cattle from the immediate vicinity, and that proper precautions be taken at all times to protect the springs from pollution; that the present sewage disposal plant in the vicinity of the well be abandoned and another provided, plans for which shall be approved by this Department as required by law; and that all privies within 500 feet of the well be provided with water-tight containers and maintained in a satisfactory sanitary condition.

CANTON

A reinspection of the public water supply of the village of Canton was made by Mr. Earl Devendorf, assistant engineer in this Department, on July 8, 1920, a previous inspection having been made on June 29, 1919.

Canton is located on the DeGrasse river, in the central part of St. Lawrence county, about 60 miles north of the city of Watertown. The population is approximately 2,760, exclusive of the students, officers, and employees of the St. Lawrence University and the State Agricultural College, who number about 600.

The village is provided with a sanitary sewer system which discharges into the DeGrasse river a short distance below the pumping station formerly used to pump water from the river for the public water supply. This source of supply has not been used since January 1, 1919.

The present water supply is derived from seven springs connected to form two groups, one consisting of the Barrett, O'Brien, Allen, Matthews, and Dinsdale springs, and the other the Barriger and Coller springs. All the water from the springs is treated with liquid chlorine applied at the rate of 0.4 parts per million.

At the time of the inspection the conditions on the watersheds were practically the same as those described in the former report. The buildings at the O'Brien and Allen springs have, however, been removed, and the village now owns and has just completed the erection of fences around the watersheds of all the springs, with the exception of a portion of the watershed of the Coller spring which has not yet been purchased. This area covers about 1½ acres and consists of a wooded pasture lot. The major portion of the watershed of this spring consists of muck land through which collecting channels have been dug to convey the water to the intake reservoir. The depth of the muck is said to vary from 3 to 6 feet. It is the intention of the village authorities to remove this muck, and for that purpose the village has purchased two Kopple cars and some 400 feet of industrial track. The watershed of the Barrett spring will at times receive the road wash of the little used dirt road. In the reservoirs of the Matthews, Coller, Dinsdale, and Barriger springs some algae growths were present. These growths are kept down, however, by the frequent use of copper sulphate. In this connection it would seem desirable that consideration should be given to covering these reservoirs to prevent growths of algae.

The village authorities have applied to this Department for the enactment of rules to protect the sanitary quality of their supply in accordance with the recommendations of the Conservation Commission when the permit was granted for the construction of the present supply.

The pumping station formerly used for pumping water from the DeGrasse river was at the time of the inspection still connected to the distribution system, and is separated from it by means of an 8-inch gate valve, the village authorities being reluctant to abandon the pumping station entirely because of the ever-present possibility of a break occurring in the main supplying the village when it would become necessary to provide an additional supply. If this pumping station is retained, the village authorities should remove the bonnets and gates of the two 8-inch gate valves on the discharge of the pumps, or take some other similar precaution to make it impossible for an unauthorized person to operate the pumping station and pump the raw water from the DeGrasse river into the village distribution system. The containers holding hypochlorite of lime to be used in the temporary sterilization plant provided at the pumping station had all broken open at the time of the inspection. In this connection it would be well to have a cylinder of chlorine kept constantly at the pumping station in order that the supply may be chlorinated if it should become necessary to use this source of supply.

As a result of the investigation the following conclusions were drawn:

1. That the previous recommendations of this Department have been carried out with the exception of the removal of the cross connection between the DeGrasse river pumping station and the village distribution system.
2. That the analyses of samples of water from the east line of springs indicate that these springs are subject to some contamination, probably of animal rather than human origin.
3. That, as is true of all surface supplies, the supply is subject to the local or chance contamination by trespassers upon the watershed.
4. That the Little river supply is subject to contamination by surface wash.

It was therefore recommended:

1. That the village authorities immediately sever the cross connection between the DeGrasse river pumping station and the village distribution system by removing the bonnets of the valves on the discharge lines of the pumps as pointed out above, or by removing a section of pipe from the discharge line.
2. That provision be made to treat the DeGrasse river supply with liquid chlorine before pumping into the village distribution system should occasion for its use ever arise.
3. That the village authorities purchase and fence the remaining portion of the watershed of the Coller spring.
4. That in view of the results of the recent examination the village authorities continue to operate the chlorination apparatus and treat the supply with adequate amounts of chlorine at all times.

5. That the Little river supply should in no case be used as an auxiliary supply without sterilization by means of liquid chlorine.

6. That as previously recommended the village authorities frequently flush all the dead ends of the distribution system.

7. That the village authorities consider the matter of covering the reservoirs of the various springs in which algae growth occur.

8. That when the water rules recently prepared by this Department and now before the Board of Water Commissioners of the village for their consideration have been enacted, the village authorities post the watershed and make frequent inspections to discover and remove any sources of contamination which may be found to exist.

CASTLETON

A reinspection of the water supply of the village of Castleton was made on June 3, 1920, by Mr. W. J. Erickson, engineering assistant. Previous inspections of this supply were made by this Department in 1912, 1914, and 1917, the reports upon which are published in the Annual Reports of the Department for the respective years.

Castleton, which is an incorporated village of 1,583 inhabitants, is located on the east bank of the Hudson river, 9 miles south of Albany on the New York Central railroad. The supply is owned and operated by the village under the direction of the board of trustees. About 90 per cent of the population of the village uses the public water supply.

The supply is derived from Volkie kill by impounding the creek water in a storage reservoir located about 3 miles east of the village. The water is conducted by gravity through a distributing system consisting of about 11 miles of mains varying from 6- to 16-inches in diameter on which there are some 300 service taps, all metered. No data is available as to the consumption.

A concrete intake chamber is located at the side of the stream about 500 feet above the reservoir. A small rock dam serves to divert the water into the intake chamber. The main stream flows in its natural channel around the reservoir and carries the heavier sediment with it in times of heavy runoff. From the intake chamber the water flows to a small screen chamber 10 feet distant, and from there to either the reservoir or to a small storage chamber located below the reservoir.

The reservoir is about 2 acres in area and is quite shallow. Considerable trouble is experienced from algae for which the water is treated with copper sulphate. The reservoir was last cleaned three years ago. It is protected from surface wash by a 3-foot embankment.

The small storage chamber was constructed three years ago below the reservoir. It is formed by subdividing a concrete reservoir by a concrete wall so that a smaller reservoir is formed, 3 by 17 feet in plan and 12 feet deep, having a capacity of about 3,240 gallons. In summer the supply is taken mainly from this reservoir.

The watershed has an area of about 6 square miles, most of which is cleared and used for farming and grazing. The total population is about 200, or 33 per square mile. The upper half of the watershed is rather hilly while the area nearer the reservoir is more level. The soil is sandy gravel over shale and slate.

The sanitary conditions on the watershed are about the same as described in the previous report. Several highways traverse it and there are about 40 houses on it most of which are located well back from the stream and its tributaries. The Shufelt place mentioned in the previous report is about a mile above the reservoir on the Albany Post road. The hog-pen mentioned as being located 15 feet from the stream has been cleaned and abandoned. There is, however, a barn close to the stream and a manure pile located about 30 feet from the stream. With this exception there seems to be no serious condition upon the watershed, although as it is a farming region there is considerable wash from farm lands at times of heavy rain.

The supply has been depreciated as to its aesthetic quality by bad tastes and odors. Considerable trouble has also been experienced by eels clogging the house pipes.

Samples of the village supply were collected at a tap in the village and sent to the Division of Laboratories and Research for analyses. The results of these analyses are as follows:

Color	trace	Oxygen consumed	1.4
Odor, hot	lv	Chlorine	1.6
Odor, cold	lv	Hardness, total	122.8
Turbidity	0	Alkalinity	104
Ammonia, free	.002	Bacteria per c.c.	60
Ammonia, alb.	.068	B. coli type, 1/10 c.c.	3+0—
Nitrites	.001	B. coli type, 1 c.c.	2+1—
Nitrates	.300	B. coli type, 10 c.c.	0+3—

The analyses show a water that is hard and at times very turbid and colored. The figures for ammonia compounds are fairly high, especially those for albuminoid ammonia, denoting the presence of some organic pollution probably largely of vegetable origin. The total counts are moderately high and the presence of B. coli in almost all 10 c.c. and 1 c. c. volumes, and occasionally in 1/10 c.c. volumes, indicates the presence of considerable active contamination of human or animal origin.

In view of these facts it was concluded that the recommendations of the previous report of this Department have not been fully carried out, and that the supply is subject to incidental contamination and pollution by surface wash and is not suitable for human consumption without proper treatment.

It was therefore recommended that the village authorities carry out the recommendations of the previous report of this Department regarding the installation of a filtration and sterilization plant.

CENTRAL ISLIP (State Hospital)

Plans for proposed extensions to the water distribution system of Central Islip State Hospital, Central Islip, N. Y., to serve additional quarters for acute patients, were submitted to this Department for approval by the State Architect, April 29, 1920, and after careful consideration by the Engineering Division were approved on May 3, 1920.

CHATHAM

A reinspection of the water supply of the village of Chatham was made on January 9, 1920, by Mr. Earl Devendorf, assistant engineer. Previous inspections of this supply were made by this Department in 1911 and 1918, the reports upon which are published in the Annual Reports of the Department for the respective years.

Chatham is an incorporated village of about 2,200 inhabitants, located in the north central portion of Columbia county, on the Stoney kill, a tributary to Kinderhook creek, 22 miles southeast of Albany.

The public water supply is owned by the village and operated under the direction of the board of trustees. There are two sources of supply, namely the Blinn and Palmer well supplies. The Blinn supply consists of 20 driven wells located about 1 mile east of the village. The Palmer supply, which consists of a dug well, is located below the village level and a short distance from Smith pond. From these wells the water is pumped to the village distribution system, and the excess over consumption goes to a reservoir 1 acre in area located on a hill about ¼ of a mile north of the village and having a capacity of 4,000,000 gallons. The consumption varies from 300,000 to 350,000 gallons per day, of which consumers use 150,000 gallons per day, giving an average domestic consumption of approximately 70 gallons per capita per day.

At the time of the present inspection the Palmer well was in use and had been used continuously since July 16, 1919, at which time the contract with the power company for the operation of the pumping equipment located at the Blinn pumping station expired.

It has been planned to locate a new laundry about 300 feet north of the Palmer pumping station and near a large gravel pit located not far from the well. The engineer was informed that the wastes were to be discharged into the gravel pit, which at times when the pump is shut down is said to fill with water, indicating that the ground water at this gravel pit is tributary to the well. Under such conditions the laundry should not be located as proposed but at a point remote from the sources of the public water supply, and the wastes properly disposed of so as not to affect the ground water tributary to the water supply of the village.

In other respects the conditions of both pumping stations and the supply were approximately the same as described in the former report.

In view of these facts it was recommended that the village authorities continue as in the past to keep the grounds surrounding the wells in a clean and sanitary condition; to have frequent analyses made in order that the occurrence of any active contamination of the water supply may be discovered and eliminated; that another location be secured for the laundry other than that proposed near the Palmer well, care being taken so to locate the laundry and so to take care of the wastes discharged that there will be no opportunity for pollution of the ground water sources of the village water supply; and that, as previously recommended, a system of sanitary sewers be installed as soon as possible.

CINCINNATUS

A reinspection of the water supply of the village of Cincinnatus was made on June 4, 1920, by Mr. A. I. Howd, assistant engineer. Previous inspections of this supply were made by this Department in 1912, 1915, and 1918, the reports upon which are published in the Annual Reports of the Department for the respective years.

Cincinnatus is an unincorporated village located in the southeastern part of Cortland county, and has a population of about 500 people. It is on the Otselic river, and is the eastern terminus of the Cortland branch of the Delaware, Lackawanna and Western railroad, about 19 miles east of Cortland. The waterworks are in charge of a board of water commissioners.

The water supply is obtained from springs located about 2 miles southwest of the village, and a reserve supply is available from a well at the plant of the Reid Ice Cream Co. The water from the various springs is collected in a concrete basin from which it flows by gravity into the distribution system, the surplus over consumption going into a concrete reservoir 50 feet in diameter and 12 deep having a capacity of about 175,000 gallons. There are about 4½ miles of mains ranging from 3 to 8 inches in diameter and about 100 service taps of which approximately 95 per cent are metered. The water is not subjected to purification.

The recent inspection disclosed the fact that conditions remain practically the same as at the time of the previous inspection. No action has been taken by the authorities in charge of the water supply on our recommendations on the following matters: The construction of trenches above the springs, the raising of the masonry of the springs and catch-basins, and the fencing of an area around the springs to prohibit trespassing. The storage reservoir has not been covered to exclude sunlight and thus prevent algae growths. The cultivation of land above the springs, however, has been abandoned.

At the time of the inspection there was a small quantity of a green and brown scum on the surface of the water of the reservoir. A sample of the scum was collected and when later examined under the microscope was found to be an algae growth or aquatic plant, consisting of numerous types of Diatomaceae and Chlorophyceae. The water which had a greenish color is practically stagnant in the reservoir except during times of heavy draught, when the water enters the distribution system. Algae and other microscopic organisms grow most luxuriantly in still water and can develop in water in the presence of light. Better circulation in the reservoir might be provided by having the inlet pipe near the top on one side of the reservoir and having the outlet pipe near the bottom on the opposite side of the reservoir. It has been previously pointed out to the village authorities that the reservoir should be covered to exclude sunlight and thus prevent the growth of algae.

The result of the bacteriological analysis of samples of the water collected at the time of the inspection showed a fairly low total count, and the absence of organisms of the B. coli type in all the inoculations examined indicating that the water was apparently free from active contamination at the time the samples were taken.

In view of the above facts it was concluded that the village authorities have not carried out important recommendations of the previous report of this Department, that algae and other growths have occurred in the storage reservoir causing at times complaints of odors and tastes in the water, and that at times the water does not seem to flow readily through the pipe line from the springs to the village.

It was therefore recommended that the village authorities in charge of the public water supply of Cincinnatus be urged to carry out the previous recommendations of this Department that have not been acted upon; that the storage reservoir be covered, and if possible better circulation of water in the reservoir be provided; and that the village authorities consider the question of employing a competent engineer to investigate the matter of flow of water from the springs to the village.

COBLESKILL (Schoharie State School of Agriculture)

Plans for a water supply connection to serve the home economics building at the Schoharie State School of Agriculture at Cobleskill, N. Y., consisting of State Architect's drawing No. 2034, were submitted to this Department for approval by the State Architect on March 24, 1920. After careful examination of the plans by the Engineering Division they were approved on March 26, 1920.

COHOES

A reinspection of the water supply of the city of Cohoes was made on June 30, 1920, by Mr. Earl Devendorf, assistant engineer. Previous inspections of this supply were made by this Department in 1908 and 1918, the reports upon which are published in the Annual Reports of the Department for the respective years.

Cohoes is a city of some 25,000 inhabitants located 9 miles north of Albany on the Delaware and Hudson railroad, and on the Mohawk river at the site of the falls known as the Cohoes Falls. The public water supply is owned and operated by the city under a board of public works.

The water supply is obtained by pumping from the hydraulic canal furnishing power for the knitting mills. The water is pumped to a sedimentation basin located near the treatment works about 1¼ miles west of the city hall. From the raw water sedimentation basin the water flows by gravity through the filter plant and is distributed by gravity, except for that portion of the city lying west of the old Erie canal, which is supplied by pumping directly into the distribution system, the excess over consumption going to the standpipe. This standpipe is located at the filter plant and is 25 feet in diameter and 50 feet high, having a capacity of 182,000 gallons. The consumption varies from over 8,000,000 gallons per day during the winter when the faucets are left open to prevent freezing, to about 6,000,000 gallons per day during the summer. This corresponds to per capita rates of 320 gallons and 240 gallons per day respectively. The raw water sedimentation basin has a capacity of 75,000,000 gallons, or approximately 10 days' supply. The storage reservoir for filtered water has a capacity of 12,000,000 gallons. or nearly 2 days supply.

The filter plant consists of 8 gravity mechanical filters having a total area of 2,640 square feet. The beds are underlaid with manifolds over which are perforated cap strainers having 3/64-inch openings. Over the strainer is 9 inches of graded gravel and 27 inches of Cape May sand. The water is held at about 3 foot depth over the sand. The filter run varies from 8 to 16 hours before washing, depending upon the character of the raw water being treated. The rate of operation varies from 90 to 130 million gallons per acre per day. The filters are washed with air and filtered water, the air being used for about 3 minutes at 6 pounds pressure and water being applied for approximately 3 minutes. The first filtrate is wasted for approximately 5 minutes or until clear. The average amount of wash water used for the period from January to June, 1920, as taken from the monthly record of operation, varied from 9 per cent to 1.53 per cent of the total volume of water treated.

The recent inspection was made as a result of word reaching this Department that a serious break had occurred in one of the water mains, necessitating the pumping of raw water into the distribution system. It developed that on account of the break in the 24-inch feeder of the water supply system on North Mohawk street it had been necessary to close down the filter plant and pump raw water into the city mains. The filter plant was closed down for a period from about 11 P. M. on June 26, 1920, to midnight, June 27, approximately 24 hours. During this time an emergency chlorination plant was installed in the Harmony Mills pumping station, and the water sterilized with hypochlorite under the supervision of Mr. James Caird, chemist and bacteriologist. During the period and for some few days after, the people were warned by notices printed in the public newspapers against using the water for drinking or culinary purposes without boiling. In this connection it would seem desirable that the authorities in charge of the water supply should consider the matter of installing such additional piping and valves as to provide dual pipe lines both from the pumping station to the filter plant and from the filter plant to the distribution system.

On January 1, 1920, the city authorities in charge of the waterworks engaged Mr. James Caird, chemist and bacteriologist of Troy, N. Y., to assume control of the operation of the filter plant. A representative of Mr. Caird's office makes daily visits to the plant, checking the operation and making tests for turbidity, color, alkalinity, and also bacterial counts and presumptive tests for B coli. Complete daily records are kept and monthly reports are made to the city authorities in charge of the public water supply.

On account of the shortage of alum, due to transportation difficulties, it has been necessary on different occasions to operate the filter plant without the application of alum. On two occasions, in March and May respectively, the hypochlorite plant has been out of order and the filtered water was not sterilized at these times.

Trouble from algae growths in the raw water sedimentation basin was experienced in the early summer months. These growths were mostly astrionella, and on June 17, 1920, copper sulphate was applied to the raw water sedimentation basin at a rate of 3½ pounds per million gallons, which has eliminated the trouble.

At the time of the inspection samples of water from various points were collected and sent to the Division of Laboratories and Research for analysis. The results of the analyses of the raw water show a moderately hard water having some color and turbidity. The figures for nitrogen in its various forms, oxygen consumed, and chlorine are high, and indicate the presence of considerable organic matter, some of which is probably of animal origin. The results of the bacterial examination show high total bacterial counts and the presence of organisms of the B. coli type in inoculations as small as 1/10 c.c., indicating a grossly contaminated condition of the raw water at the time of the inspection.

The results of the analyses of the treated water show a removal of 100 per cent of the turbidity, 58 per cent of the color, 39 per cent and 21 per cent of the organic matter as measured by the albuminoid ammonia and oxygen consumed contents respectively. The percentage removal of bacteria was 87 per cent while the removal of the bacteria of the B. coli type was 100 per cent.

In view of the above it was recommended —

1. That the city authorities in charge of the public water supply continue to operate the water purification plant in a careful and efficient manner under the supervision of a competent chemist.
2. That the city authorities endeavor to maintain a sufficient supply of chemicals on hand in order that there be no interruption of the application of the chemicals.
3. That the algae growth occurring in the sedimentation basin be kept down by the careful application of copper sulphate under the supervision of a competent expert.
4. That consideration be given to the matter of installing such additional mains and valves as to provide a dual feed line from above the pumping station to the filter, and from the filter plant to the distribution system, in order that any future breaks in these mains will not necessitate the introduction of unfiltered water into the distribution system for public consumpton.
5. That the city authorities in charge of the public water supply consider the matter of an underground survey to discover and eliminate any large leaks, the installation of meters to cut down public waste, and a house to house survey to discover and remedy any service leaks, in order that the present filter plant may not be overtaxed by the excessive consumption of water.
6. That if any further trouble is experienced with the present hypochlorite plant, the city authorities in charge of the public water supply consider the installation of apparatus in duplicate for applying liquid chlorine in order that there be no interruption in the sterilization of the public water supply.

COLLINS (Gowanda State Homeopathic Hospital)

Plans for a temporary or emergency auxiliary water supply to be used exclusively for laundry purposes at the Gowanda State Homeopathic Hospital, Collins, N. Y., consisting of State Architect's drawing No. 2006, were submitted to this Department for approval by the State Architect on December 11, 1920. After careful examination by the Engineering Division it was recommended that the plans be approved, with the understanding that the proposed auxiliary supply be abandoned whenever required or when a new supply becomes available; that the proposed force main be kept entirely separate from the distribution system; and that the piping be arranged so that there will be no opportunity for the use of this temporary supply for drinking or culinary purposes. The plans were approved subject to these conditions on December 14, 1920.

COLONIE

An inspection of the water supply of the Colonie Shops of the Delaware and Hudson Railroad Company, located in the town of Colonie, Albany county, was made on May 10, 1920, by Mr. W. J. Erickson, engineering assistant.

There are at present about 1,000 persons employed at these shops. Besides providing these people with drinking water and water for use in toilets and wash-rooms, the supply is used for filling the drinking water tanks on the passenger coaches and diners of the Delaware and Hudson railroad. Very little of the water is used for other purposes, water from another source being available for boilers and other industrial uses. The consumption averages about 100,000 gallons per day, of which 2,500 gallons is used for filling the passenger coach tanks.

The supply is derived from a dug well located in a level area in the southeastern corner of the shop yard and near the freight yards. The well is 60 feet in diameter and about 43 feet deep, and was dug through about 20 feet of fill and top soil, 8 feet of clay, and 15 feet of sand and gravel. It is from this latter layer that the water is derived. A concrete casing extends from the bottom of the well to about 2 feet above the ground level. The well is uncovered and debris was noticed floating on the surface of the water at the time of the inspection. The area in the neighborhood is used as a rubbish dump, but with this exception there are no permanent sources of pollution in the vicinity of the well.

The water is pumped to two storage tanks by two centrifugal pumps driven by 50-h. p. electric motors. These motors are housed in a small shed located over the suction well. The floor of this shed was oil soaked at the time of the inspection and the water from the tap flowed back into the well. The arrangement of the apparatus appeared to be only temporary. A Continental filter is located in the cellar of one of the shops. This filter was being by-passed on account of its inefficiency and insufficient capacity.

At the time of the inspection samples were collected from the well and a tap at the shops and the results of the analyses of these samples made by the Division of Laboratories and Research are as follows:

Color	5	Oxygen consumed	1.1
Odor, hot	none	Chlorine	14.
Odor, cold	none	Hardness, total	428.5
Turbidity	trace	Alkalinity	188.
Ammonia, free	.036	Bacteria per c.c.	90
Ammonia, alb.	.024	B. coli type, 10 c.c.	3+0—
Nitrites	.003	B. coli type, 1 c.c.	2+1—
Nitrates	1.00	B. coli type, 1/10 c.c.	0+3—

These results show a water that is very hard, slightly colored, and practically clear. The figures for nitrogen compounds are high, indicating considerable contamination by organic matter which appears to be of animal or human origin. The chlorine content is high for water of this district and also indicates pollution from animal or human sources. The bacterial counts are not excessive, but the presence of B. coli organisms in three of the six 1 c.c. inoculations indicates the presence of considerable active contamination.

As a result of the inspection it was recommended that the present well be abandoned as a source of supply and a new supply of safe sanitary quality be developed; that should it be necessary to temporarily retain the present well as a source of supply, it be improved by providing the well with a cover to prevent dirt and dust from blowing into it, by surrounding the well by a fence 30 feet from the well in order to prevent trespassers on this area, by discontinuing the dumping of rubbish within a radius of 250 feet of the well and by providing a water-tight floor for the pump house so that there will be no back flow into the well; that a careful analysis be made of the water after these improvements have been completed, and if active contamination is indicated, suitable apparatus be installed for the sterilization of the water, and liquid chlorine applied to the water in proper quantities continuously and at all times.

The water of this supply is used by the Delaware and Hudson railroad for drinking and culinary purposes in interstate traffic. Data regarding this supply were furnished to the United State Public Health Service on October 21, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were not satisfactory, and that the results of the inspection and the analyses of the samples indicate that the water cannot be considered to be of satisfactory quality for human consumption. A copy of the report accompanied this data.

CONIFER

An investigation of the sanitary quality of the water supply of the unincorporated village of Conifer, St. Lawrence county, N. Y., was made by Mr. A. I. Howd, assistant engineer in this Department, on September 27 and 28, 1920, subsequent to an outbreak of typhoid fever in the village.

Conifer is a lumbering village controlled by the Emporium Forestry Company, located in the northeastern part of St. Lawrence county, in the town of Piercefield. The population is about 500. The village is provided with a sewer system which serves about one-third of the population. The sewage is discharged into a cesspool which empties into Dead creek. The remainder of the village is served with privies with earth vaults.

The principal source of water supply is springs and a spring brook about three-quarters of a mile east of the village. Water is also available from several dug wells in different parts of the village. These wells are generally from 3 to 4 feet in diameter and from 8 to 18 feet deep. A separate auxiliary water supply is obtained from Pleasant lake outlet and used solely for fire protective purposes.

The springs, the main source of the public water supply, are located in a swampy area near the foot of Arab mountain, and are developed by the construction of small wooden collecting boxes from which the water flows through a pipe line to the collecting reservoir. A small dam impounds the water of the spring brook, which is also conducted to the reservoir. The watershed adjacent to the springs and spring brook is small and unpopulated and apparently not subject to contamination from any permanent source. The Grasse River railroad passes about 15 feet from the brook at a point where the water is collected, and the brook is therefore subject to incidental pollution.

As a result of the investigation it was recommended that the wells in the village be abandoned, and that the springs and spring brook be developed and protected to provide a safe water supply for the community.

COXSACKIE

A reinspection of the water supply of the village of Coxsackie was made on November 7, 1919, by Mr. W. J. Erickson, engineering assistant. A previous inspection of this supply was made by this Department in 1912, the report upon which is published in the Annual Report of the Department for that year.

Coxsackie is located in the northeastern part of Greene county, on the west bank of the Hudson river. Part of the houses are served by public sewers, the remaining houses being provided with privies and cesspools. The waterworks are owned by the village and operated under the direction of a board of water commissioners.

The public water supply is ordinarily derived from a spring fed brook known as the Diep kill, the intake being located four miles northwest of the village. From the intake reservoirs of both supplies the water flows by gravity to the consumers through 8 miles of mains varying from 6 to 10 inches in diameter.

At times of drought it has been considered necessary to augment the upland supplies by direct pumping into the mains from the Hudson river through a hose connection from the plant of the Upper Hudson Electric and Railroad Company. At these times warning notices have been published by the water commissioners advising the boiling of all water used for drinking or culinary purposes. The experience of this Department is, however, that such warnings, either through ignorance or carelessness, will usually be disregarded by a considerable proportion of the population. While there is no record of any outbreaks of typhoid fever resulting from this use of the river water, there is no question but that the practice is a most dangerous one, and one which might readily have disastrous consequences. The village, therefore, has been considering the construction of additional storage for the upland supplies to obviate the necessity of using the river water. Although bids on the construction were received this past spring, these bids were considered too high and the project has apparently been abandoned for the present.

About a quarter of a mile above the Diep kill reservoir there is a farmhouse. A privy is located in the rear of the house about 60 feet from the stream and about 40 feet from a tributary to it. This privy is not provided with a vault and excreta was noticed on the ground at the rear of the privy. Rubbish had been thrown on the bank of the stream. The field above the house is used as a pasture, and animal excreta was noticed at the edge of the stream.

About one-half mile from the reservoir there is another farm, the barnyard of which was not in a sanitary condition. A pigpen is located about 75 feet from the stream. There is a runway for cattle which extends to the stream and it bore evidences of animal excreta. The privy at the farm is provided with a wooden removable container and is located about 60 feet from the stream. It was stated that the container was removed once a month and the contents buried. The vault was full, however, at the time of the inspection. A short distance above this farm is a cow pasture located on both sides of the stream.

About three-fourths of a mile from the reservoir and at the intersection of the road alongside of the creek with a road from the south is another farm. The barnyard is located about 200 feet from the stream and was in a fair sanitary condition. In the field which extends on both sides of the stream a bull was tied, but otherwise it bore no evidences of being used for pasturage. Although time did not permit of a detailed inspection of all parts of the watershed, the above examples may be considered as typical of conditions at the various farms upon the area.

The Climax supply is derived from a subterranean stream formed by the Murderer kill which enters a sink hole about a quarter of a mile above the intake reservoir, this reservoir being located about 1½ mile northwest of the village. The reservoir is formed by a small concrete dam across the stream as it emerges from the foot of a steep cliff. The reservoir thus formed is consequently located in a cave in the cliff. The Murderer kill has a drainage area of about 6 square miles with a resident population of 270, or 45 per square mile. This watershed could not be covered in the time available for the inspection, but as it is located adjacent to the Diep kill watershed, the conditions thereon are probably similar to those on the Diep kill area.

At the time of the inspection samples were taken of the Diep kill supply, the Climax supply, and from a tap in the village, and sent to the Division of Laboratories and Research for analysis. The results of the analysis of the Diep kill supply showed a water that is moderately hard, highly colored, and at times turbid. The figures for nitrogen in its various forms were fairly high, showing the presence of moderate amounts of decomposing and decomposable organic matter. The figures for chlorine were above the normal for the region. The total bacterial counts were usually high, and organisms of the B. coli type present in the majority of 10 c.c. and 1 c.c. inoculations and occasionally in the 1/10 c.c. inoculations. The water from the Climax supply was similar to that from the Diep kill supply. The figures for nitrogen and oxygen consumed showed a water that contained considerable organic matter. The total bacterial counts were high, and B. coli were present in some inoculations as small as 1/10 c.c.

The analyses of the tap samples showed a supply of variable color and turbidity with moderate amounts of organic matter and of fairly high hardness. The bacterial counts were variable but usually high, and B. coli were more than moderately prevalent. These results indicated that the supply was actively contaminated at the time the samples were taken.

As a result of the inspection it was recommended:

1. That the village authorities make regular and thorough inspections of all parts of the watersheds of the Diep kill and Climax supplies, and that in accordance with the provisions of section 70 of the Public Health Law they secure the abatement of any violations of the rules and regulations found thereon.
2. That the village take steps for installing a modern filter plant, supplemented by sterilization, for the purification of the water supply.
3. That pending the installation of a filter plant, liquid chlorine apparatus be installed at once for the sterilization of the supply.
4. That in order to obviate the necessity for the occasional emergency use of the Hudson river, sufficient storage be provided for the present upland supplies or other streams if available be developed.
5. That until an adequate upland supply is secured, the village purchase apparatus for the proper sterilization of the river supply whenever it becomes absolutely necessary to resort to that source.

DAVENPORT

A reinspection of the water supply of Davenport was made on October 16, 1920, by Mr. W. J. Erickson, sanitary inspector. A previous inspection of this supply was made by this Department in 1915, the report upon which is published in the Annual Report of the Department for that year.

Davenport is an unincorporated village of about 300 inhabitants; it is in the northern part of Delaware county, about 12 miles east of Oneonta, in the Charlotte Creek Valley. Davenport Center, on the Ulster and Delaware railroad, and 5 miles west of Davenport, is the nearest railroad station. The water supply is owned and operated by the Davenport Water Company, about 200 use the water supply furnished by the company. There is no public sewer system in the village.

The supply is derived from four springs located about half a mile southwest of the village. From these springs the water is conducted to a covered storage reservoir. From this reservoir the supply is delivered by gravity to the consumers through about one and a quarter miles of mains varying from 4 to 6 inches in diameter on which there are some 32 service taps, none of which are metered. The pressure in the village is about 65 pounds per square inch. The consumption is estimated at 12,000 gallons per day, or about 60 gallons per capita.

The springs are developed by the construction of four collecting wells. These wells have stone walls, concrete bottoms, and are covered with wooden roofs. The water enters through tile drains extending through the stone walls. Four-inch pipes conduct the water from the springs to the reservoir located just below the easterly springs. These effluent pipes rest on the bottom of the spring wells and are provided with castiron strainers having holes ½-inch in diameter. The reservoir is of concrete, 20 feet by 40 feet in plan and 10 feet deep, with a capacity of about 60,000 gallons. A substantial wooden roof covers the reservoir. A pipe extending perpendicularly from the bottom acts as an overflow. Earth banked around the collecting well and reservoir diverts the surface wash.

The watershed above the spring is about 15 square miles in area, though it is possible that about a square mile may contribute to the underground water feeding the springs. There are no houses on the watershed. The fields above the springs are used for pasturage and it is probable that some contamination reaches the supply from this source. A stream drains into the ground above the springs and it is probable that they are largely fed from this source. Above the springs are outcrops of sandstone and shale while below are more or less impervious layers of sand and gravel.

The results of the analyses of samples of the water taken at the time of the inspection showed a water that is soft, practically clear, and colorless. The organic matter was moderate and probably largely of vegetable origin. The chlorine content was not excessive for waters of the section. The total bacterial counts were moderate. The presence of organisms of the B. coli type, however, indicated some active contamination.

From the results of the inspection it was concluded that the supply though subject to some contamination from pasture lands and from accidental or willful contamination of human origin may be considered to be of fair sanitary quality.

It was therefore recommended that the area surrounding the springs be fenced off to keep cattle and people away from the immediate vicinity, and that the watershed of the brook above the spring be abandoned for pasturing cattle, especially that portion along the banks of the brook.

DEFERIET and HERRING

An investigation of the water supply of the villages of Deferiet and Herring was made on August 1, 1919, by Mr. Earl Devendorf, assistant engineer.

Deferiet is an incorporated village of some 500 inhabitants located on the Black river, in the town of Wilna, Jefferson county, N. Y., some 2 miles east of Great Bend. The village authorities all work in the mill of the St. Regis Paper Company which is located there. The water supply is derived from two springs and six drilled wells, located in the village, from which the inhabitants carry water to their houses.

One of the wells known as Block well is situated on a level piece of ground some 500 feet back from the Black river and 75 feet distant from the nearest house. The water level in the river was some 40 feet lower than the ground surface near the well. This well is drilled to a depth of 70 feet through earth, quicksand, and hardpan, rock being encountered at a depth of 60 feet. A force pump is provided for raising the water; and a wooden cover which is not tight.

The School well is a drilled well located some 300 feet from the river and is said to be 67 feet in depth, all of which depth is reported to be through rock. A row of houses is located west of the well at a distance of approximately 100 feet.

The River well is located some 200 feet from the river, and the ground surface surrounding the well was some 40 feet above the water level in the river at the time of the inspection. A row of houses is located some 100 feet east of the well. This well is drilled to a depth of 40 feet, of which all but the first 8 feet is in rock.

The Railroad well is located between the highway and the railroad tracks, 100 feet from the nearest house. The land on the railroad side slopes toward the well. A wooden cover is provided which tends to deflect any surface wash. This well is only 40 feet in depth and all but the first 6 or 8 feet are in rock.

On the other or northern side of the railroad from the above described wells, there are two other wells known as the Bungalow and Italian wells. The Bungalow well is located on the top of a small incline in front of a row of small houses. A cesspool is located at the bottom of the incline at a distance of some 300 feet from the well. This well is drilled to a depth of 84 feet, of which all but the first 14 feet is in rock.

The other well is located in front of a block occupied by Italian workmen from which it has derived the name of Italian well. This block is served by privies, while the other houses and bungalows are provided with inside toilets which are supplied with the river water for flushing purposes. The privies are located in the rear of the houses and the nearest privy is at a distance of some 150 feet from the well. This well is drilled to a depth of 60 feet, of which all but the first 14 feet is in rock.

As previously stated, there are two springs from which water is obtained for drinking and culinary purposes. One of these springs, known as the Bridge spring, is located along the bank of the river and is wholly unprotected from pollution, either by surface wash or by trespassers passing near the spring. At the time of the inspection human excreta were observed in the vicinity of the spring.

The other spring, known as the Mill spring, is located about 1,000 feet north of the mill. No sources of pollution were observed in the vicinity of this spring at the time of the inspection, and the analysis of the sample of water taken from the spring showed a low count and the absence of bacteria of the colon type.

Throughout this section of the country under consideration the land is almost all rock having very little soil covering. The prevailing rock material is limestone. Under the above described conditions the matter of putting down wells in the village, where cesspools and sewers are located, is attended with the danger of contamination from these sources. The wells, however, are all drilled 5 inches in diameter with casing constructed in rock in an attempt to prevent surface infiltration. Nevertheless, there is no assurance that pollution from the above described houses may not enter the ground water sources tributary to the wells through fissures at any time. The springs are wholly unprotected.

At the time of the inspection of the Deferiet water supply an inspection was also made of the well located at Herrings, where the St. Regis Paper Company maintains a hotel for its employees. There were approximately 100 persons living at the hotel at the time of the inspection.

The water supply is derived from a dug well located at the side of the hotel which was not satisfactorily covered or curbed, thus giving opportunity for surface wash to enter the well. A cesspool was located some 300 feet distant and at an elevation of approximately 30 feet below the ground surface surrounding the well. The nearest privy is at a distance of approximately 75 feet and at a lower elevation. There were no direct sources of pollution observed at the time of the inspection.

As a result of the investigation, it was recommended that the present sources of water supply for potable purposes of Deferiet and Herrings, derived from wells and springs subject to pollution, be abandoned, and that the company secure the services of a competent sanitary engineer to aid it in securing another supply for both Deferiet and Herrings which will be sufficient in quantity and of a proper sanitary quality for their needs for all purposes, and that the use of the river water in the houses be discontinued at the earliest possible time following the installation of a proper water supply system.

DEFREESTVILLE (Bottled Water)

An inspection of the sanitary condition of the spring and bottling works of the Morgan Spring Water Company at Defreestville, Rensselaer county, N. Y., was made on July 27, 1920, by Mr. Henry Ryon, assistant engineer, and Mr. W. J. Erickson, sanitary inspector, in this Department.

The spring is located a quarter of a mile north of Defreestville, and about 3 miles northeast of the city of Rensselaer. It is now owned by F. A. and W. A. Platt, who purchased it from the Morgan Spring Water Company a short time ago. About 500 gallons of water per day are delivered by the owners to their own customers, and about 1,000 gallons furnished to Mr. Wyle of Albany, who states that he distributes it under the name of "Ferndale Spring Water."

The water furnished to the offices in the capitol by Mr. Wyle is from this spring. The water is delivered in 5-gallon and 1-gallon bottles. The former are provided with wooden crates generally marked "Conservation Commission, State Reservation, Saratoga Springs," and the latter are shipped in boxes containing six bottles marked in the same manner. In some cases the large bottles bear the seal of the State, blown on the glass, and the words "Conservation Commission, Ferndell Springs." It should be noted that the water formerly distributed by the Conservation Commission was "Ferndell Spring Water," while that now being distributed by Mr. Wyle is sold as "Ferndale Spring Water."

The spring is located about 500 feet west of the road and about 20 feet lower than it. It has been dug out and walled up forming a well about 4 feet wide and 8 feet long. The upper portion of the walls of this well is laid with cemented joints, while the lower portion is of dry rubble to allow the water to enter. The well is covered with a peaked wooden roof which is provided with a trap door. The ground in which the well is located slopes in such a way that the surface wash is diverted away from the well. A few feet east of and above the spring is a pump house equipped with a gasoline engine and is used to pump the water to the bottling plant through a 1¼-inch galvanized iron pipe.

The soil in the vicinity is apparently a residual soil underlain at no great depth with shale. Immediately east of or above the spring is a hay field extending for a distance of about 250 feet, and above this is a potato patch extending to the road. A stable belonging to the owner of the plant is located about 300 feet from the spring toward the road, and there is a privy just south of the stable. Both are on higher ground than the spring, but the topography of the ground is such that it seems improbable that any surface drainage from the stable or privy can reach the spring.

The room where the bottles are filled is about 10 feet by 15 feet in size and has a rough wooden floor. Two doors lead to platforms outside the building and a third leads to the kitchen of the adjoining dwelling. The water on reaching the bottling room passes through a Jewell pressure filter about 1 foot in diameter and 4 feet high to an elevated receiving tank over the bottling table. The filter is provided with an alum pot, but according to the statements of Mr. Platt no alum is applied. The filter is cleaned by reversing the flow, and the sand agitated by rakes operated by means of a hand lever. There are no records available to indicate how often sand is washed.

The receiving tank, located below the ceiling in the side of the bottling room, is about 10 feet long, 3 feet wide and 3½ feet deep, and is lined with galvanized iron. Its capacity is between 500 and 600 gallons. Three taps located on the under side of the tank are provided for filling the bottles. A rough table has been constructed under these taps, consisting of planks with open joints under a sink of galvanized sheet-iron which collects the water falling on it and discharges it into a drain leading to a cesspool about 40 feet west of the building which also receives the drainage from the floor.

No provision is made for thoroughly cleaning the returned bottles, and unless they are unusually dirty they are simply rinsed out and refilled. When they are not as clean as is desired a brush is used. No hot water or soap is used in cleaning them. It was stated by Mr. Platt, however, that he intends to install a steam boiler so that the bottles can be sterilized with steam before being refilled.

Samples were taken at the spring and the bottling taps at which the bottles are filled, and sent to the Division of Laboratories and Research for analysis. One five-gallon bottle and 2 one-gallon bottles of the water as delivered to the Capitol were also sent to the Division of Laboratories and Research for analyses. The results of the examination of these samples show a water that is clear, colorless, and hard. The figures for nitrogen as free, and albuminoid ammonia and nitrates are in general low, while that for nitrogen as nitrates is fairly high. This would seem to indicate considerable pollution by organic matter which has been largely oxidized and rendered inert by the natural processes of purification in passing through the soil. The total bacterial counts are moderate, but organisms of the B. coli type were present in all but 1 sample tested, denoting the presence of slight amounts of active contamination. As the B. coli were found in the samples from the spring and tap as well as in the samples of bottled water, it is apparent that the contaminated matter reaches the water in the spring and is not due entirely to the handling of the water and bottles. It seems probable that the organic matter in the water is largely of vegetable origin, although some is undoubtedly of animal origin and derived from the cultivated and fertilized fields above the spring, and possibly from the barnyard. It seems probable also that the active contamination of the water as indicated by the presence of B. coli is from the cultivated fields and of animal rather than human origin, although it is of course possible that incidental pollution of the watershed by human beings may have occurred. In the case of the samples from the bottled water, it is very possible that the presence of B. coli may have been due to contamination of the bottles in washing and handling.

In view of the above facts it appears that the spring of the Morgan Spring Water Company while it receives no gross pollution is not located in an entirely satisfactory manner for producing a water of unquestionable purity, and at times receives active contamination, probably from the cultivated field above the spring; and that the method used for cleaning and refilling the bottles is not entirely satisfactory, as although the bottles are rinsed with cold water, no attempt is made to sterilize them or the stoppers.

DELANSON

A reinspection of the water supply of the village of Delanson was made on October 13, 1920, by Mr. W. J. Erickson, sanitary inspector. A previous inspection of this supply was made by this Department in 1916, the report upon which is published in the Annual Report of the Department for that year.

Delanson, which is an unincorporated village of about 400 inhabitants, is located in the southwestern part of Schenectady county, about 15 miles south of Schenectady. It is largely a railroad center, being the junction of the main line and a branch line from Schenectady and the north. The supply is owned and operated by the Duanesburg Water Company. There are no public sewers in the village.

The water supply is derived from two small streams tributary to the Normanskill. These streams are developed by the construction of dams across them, thus forming reservoirs. They are located 4 miles and 1½ miles respectively north of the village. From the upper stream the supply is conducted through a pipe to a stream where it runs in an open channel to a small intake well located 2 miles below the reservoir, from which it is conveyed through a pipe line to the lower storage or distributing reservoir.

From the distributing reservoir the supply is conducted by gravity through about 5 miles of water mains varying from 4 to 8 inches in diameter, on which there are about 30 service taps. Only the railroad supply is metered. There are about 150 consumers and the consumption is estimated at 17,000 gallons per day. About 300,000 gallons per day are used by the railroad. The average pressure in the village is approximately 60 pounds per square inch.

The upper reservoir, developed by the construction of a long dike or dam across a stream, forms a rather narrow shallow reservoir of about 50,000,000 gallons capacity. It is filled with stumps and is evidently the bed of an old swamp. A spillway under the road passing along the dike allows the excess to pass off down the natural stream. From the reservoir the water is conducted through a castiron pipe for about a mile, thence in a natural channel to the intake well. This well is about 10 feet deep and about 4 feet square. The water enters the well through the open joints in the stone wall. Inside the well is a cylinder which is surrounded with a fine mesh copper wire, through which the water must pass before entering the intake pipe. From this intake the water flows by gravity to the distributing reservoir. This reservoir, which has a capacity of about 30,000,000 gallons, is in a better condition than the upper reservoir. The bottom appeared to have been recently cleaned and there was only a small proportion of marshy land at the upper end. A fence surrounds the reservoir. A road, however, crosses the upper end.

There are about 2⅓ square miles of watershed tributary to the upper reservoir on which there are about 10 houses. The area tributary to the distributor is about a quarter of a square mile on which there is one house. This gives a total population of about 40 for the 2 watersheds, or about 15 per square mile. These houses are far removed from the reservoirs or tributary streams except as noted below. There is one farm located on the south side of the upper reservoir. The dwelling and privy are located on the downstream side of the dike and so the drainage is not toward the reservoir. The barn and chicken yard, however, are on the bank of the reservoir, and it seems probable that at times surface wash from these places as well as from the road reaches the reservoir.

The lower reservoir is subject to contamination which may reach it from the road crossing it and to pollution from chance visitors in the vicinity. The water is rendered very turbid at times of heavy rainfall.

At the time of the inspection samples were collected and sent to the Division of Laboratories and Research for analyses, the results of which are as follows:

Color	20	Oxygen consumed	8.2
Odor, hot	1a	Chlorine	.4
Odor, cold	1a	Hardness, total	36.4
Turbidity	3	Alkalinity	35.5
Ammonia, free	.002	Bacteria per c.c.	175
Ammonia, alb.	.136	B. coli type, 10 c.c.	2+1—
Nitrites	Tr.	B. coli type, 1 c.c.	1+2—
Nitrates	.08	B. coli type, 1/10 c.c.	0+3—

These results show a water that is moderate in hardness, slightly colored, and turbid. The ammonia content and oxygen consumed indicate some organic contamination which appears to be largely of vegetable origin. The chlorine is only slightly above normal for water in this section. The total bacterial counts are moderate. Organisms of the B. coli type indicate the presence of some active contamination.

As a result of this investigation it is recommended:

1. That regular inspections of the watershed be made to detect sources of contamination, and all unsatisfactory conditions discovered be immediately corrected and proper precautions taken to prevent their recurrence.
2. That should any difficulty be experienced in carrying out the foregoing recommendations, the company apply to this Department for the enactment of rules and regulations for the protection of the sanitary quality of the supply.
3. That in view of the possibility of accidental or willful contamination by residents or visitors on the watershed and by surface wash from the road across the lower reservoir, the water company immediately install and put in operation a suitable chlorination plant, and consider the installation of some modern plant for further safeguarding the sanitary quality of the supply.
4. That the water company consider the re-location of the road around the lower end of the distributing reservoir and thus remove a dangerous source of contamination.

The water of this supply is used by the Delaware and Hudson railroad for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on November 15, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were not entirely satisfactory, and that the results of the inspection and the analyses of the samples, together with the results of previous inspections and analyses, indicate that the water was not of entirely satisfactory quality for human consumption. A copy of the report accompanied this data. Based on this information, the United States Public Health Service on November 17, 1920, issued a provisional certificate permitting the temporary use of the water for drinking and culinary purposes in interstate traffic.

DEPOSIT

A reinspection of the water supply of the village of Deposit was made on May 19, 1920, by Mr. W. J. Erickson, engineering assistant. Previous inspections of this supply were made by this Department in 1909 and 1915, the reports upon which are published in the Annual Reports of the Department for the respective years.

Deposit, with a population of 1,779, is located partly in the southwestern part of Delaware county and partly in the southeastern part of Broome county. Of the total population, about 1,500 are served by the public supply. The waterworks are owned by the Deposit Water Supply Company.

The water supply is derived from Butler brook, about 2 miles north of the village, and from a spring-fed reservoir about a mile farther north. Both the reservoir supply and brook supply are filtered through a slow sand filter. After passing through the filter the water is delivered by gravity through a distribution system consisting of about 8 miles of castiron pipe varying from 4 to 8 inches in diameter. There are no public sewers in the village: privies, cesspools, and the like being used.

The upper reservoir, with a storage capacity of about 90 days, is formed by an earthen dam at the head of a small valley. This reservoir is mainly spring-fed, no stream entering it although at times of heavy rains it receives considerable surface runoff. There are no sources of human pollution within 1,000 feet, though the field immediately above the reservoir is used for pasturage. The reservoir is fenced so as to exclude cattle from the neighborhood. From the reservoir the water flows some 1,500 feet through an open channel to a small masonry intake dam, from which it flows through an 8-inch castiron main to the filter plant. A road passes along the open channel.

The brook supply is developed by a masonry dam across the brook, forming a small reservoir. The excess flows through a natural channel past the filtration plant. The village owns considerable land around and above the filter plant and intake, and no pasturage or cultivation is carried on within this area. Above this the watershed is almost entirely cultivated or used for pasturage. There were no direct sources of human pollution observed at the time of the inspection, but as is the case of such districts there are many possibilities of contamination of the supply.

From this reservoir the water filters through a filter dike composed of gravel into the sedimentation basin, about 200 feet by 100 feet by 10 feet deep, and having a capacity of about 5,000,000 gallons. This basin has a gravel bottom and riprap sides. From the sedimentation basin the water is conducted to the slow sand filter. The filter which is about 500 feet by 100 feet is subdivided so that one section may be cleaned while the other is in use. The filtering medium consists of 1½ feet of sand and 1½ feet of graded gravel. The sand appeared to be rather poor quality and too coarse for a slow sand filter. The piping is so arranged that filtration may be carried on either from top to bottom, or *vice versa*. The average rate of filtration is about 300,000 to 400,000 gallons per day, or about 880,000 gallons per acre per day. The filter was not in operation at the time of the inspection as the sand had just been cleaned and renewed.

From the filter the water is conducted directly to the village, the excess going to a covered clear water basin with a capacity of 178,000 gallons. This basin is of concrete and is of circular form 50 feet in diameter and about 15 feet deep. It is covered with a wooden conical roof which is covered with tar shingles. The clear water basin had just been cleaned and was practically empty at the time of the inspection.

Samples of the raw and filtered water were taken on November 8, 1920, and sent to the Division of Laboratories and Research for analyses. The result of the bacteriological examination is as follows:

	Raw	*Filtered*
Bacteria:		
Per c. c. 20°C	96,000	80,000
Per c. c. 37°C	4,900	1,900
B. coli type:		
in 10 c.c.	3+0—	3+0—
in 1 c.c.	3+0—	3+0—
in 1/10 c.c.	0+3—	0+3—

The results of the analyses show that the process of filtration produces practically no change in the chemical or bacterial content of the water, indicating a very low efficiency. The sand used is of a rather poor grade and is too coarse for use in a slow sand filter. It would seem advisable that this sand be removed, the underdrains cleaned of any growths or sediment that may aid in breeding bacteria, and a new sand of good quality and suitable size be used for the filtering medium. The sand should have an effective size of about .3 millimeter, and a uniformity coefficient of not more than 4. This bed should be about 3 feet in depth above the gravel layer which should be graduated in size, the larger sizes being placed around the underdrains.

As a result of the inspection it was recommended:

1. That regular inspections of the watersheds be made in order to detect and remove any source of pollution found thereon.
2. That the present filtering medium be replaced by a sand of suitable size and quality.
3. That the depth of filtering medium above the gravel be made not less than 3 feet.
4. That the underdrains be thoroughly cleaned.
5. That if the above improvements fail to yield a satisfactory effluent the supply be sterilized with liquid chlorine.

The water of this supply is used by the Erie Railroad Company for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on November 29, 1920, and included, in addition to the results of the analysis of a sample of water, the statement that at the time of the inspection the conditions surrounding the supply were not entirely satisfactory, and that the results of the inspection and the analyses of the samples, together with the results of previous inspections and analyses, indicate that the water cannot be considered to be of entirely satisfactory quality for human consumption unless the recommendations of our report are carried out. A copy of the report accompanied this data.

DOBBS FERRY (Palmine Company, Inc.)

An investigation of the water supply of the factory of the Palmine Company, Inc., at Dobbs Ferry, N. Y. was made by Mr. Alfred Mullikin, assistant engineer in this Department, on January 9, 1920, following a request of the factory officials for such an investigation.

The drinking water and water used for manufacturing cocoanut butter is obtained from two sources, one a spring located about 200 feet east of the factory, and the other a well about 100 feet deep located approximately 18 feet east of the New York Central railroad tracks and 17 feet north of the factory. This well is known as Well No. 2. At the eastern end of the factory there is another well known as Well No. 1, which was not in use at the time of the inspection.

In view of the results of the inspection and the analyses of samples of water taken at the time of the inspection, it was concluded that the spring and well at the Palmine Company's factory were receiving active contamination from some source, and that these sources of water supply should not be used for potable purposes without adequate protection and purification.

It was therefore recommended that these sources be properly protected from contamination, and that the water be subjected to suitable treatment before being used, and that in view of the difficulty of properly purifying such a small supply the company consider the proposition of abandoning the present spring and well and obtain a supply of pure water from a more satisfactory source.

EASTHAMPTON

A reinspection of the water supply of the village of Easthampton was made on June 4, 1920 by Mr. Alfred Mullikin, assistant engineer. A previous inspection of this supply was made in 1915, a report upon which is published in the Annual Report of the Department for that year.

Easthampton is located in the town of Easthampton, on the Montauk branch of the Long Island railroad, about 115 miles from New York city. The population varies from 2,000 in winter to about 3,000 in summer. Of the total population, 99 per cent are served with water from the public water supply. The waterworks are owned and operated by the Home Water Company.

The water supply is derived from 5 driven wells located in the western part of the village near Cove Hollow and Bridgehampton road about 1/4 of a mile southwest of the railroad station. From the wells the water is delivered through a distributing system of about 14 miles of castiron pipe ranging from 2 to 10 inches in diameter. A steel standpipe 100 feet high and 13 feet in diameter, having a capacity of 100,000 gallons, is located about 100 feet west and slightly north of the plant. This standpipe takes the surplus and acts as an equalizing reservoir maintaining an average pressure in the municipality of approximately 30 pounds per square inch. Of the 400 to 500 service taps, only about 100 are metered. The average daily water consumption in winter is approximately 200,000 gallons, or 110 gallons per capita per day, while in summer, due to increased population, the sprinkling of lawns, etc., the average daily water consumption amounts to about 800,000 gallons, or 300 gallons per capita per day.

There are three 8-inch driven wells and two 10-inch driven wells about 117 feet deep. The 8-inch wells are situated in a brick pit having a depth of 24 feet and a diameter of 13 feet, which is provided with a concrete bottom. A small amount of leakage from the pumps remains upon the floor of the pit, but this is removed occasionally by a small rotary pump. The two 10-inch wells are located 40 feet and 80 feet respectively north of the pumping plant, and are connected by a 10-inch suction main which leads into the pump pit. These two wells are provided with cemented brick pits 8 feet in diameter and with depths of 20 and 24 feet respectively. The pits are provided with concrete covers. The strata through which the wells pass consist of 6 feet of sand and 6 feet of clay with the remaining distance of sand.

The pumping plant is located in a sparsely populated section of the village on a reserved area of ground amounting to about two or three acres. There are no direct sources of pollution in the vicinity of the wells. The nearest house, occupied by the attendant in charge of the pumping plant, is about 150 feet east of the wells. The toilet of the house is provided with a cement cesspool, the effluent from which is taken care of by subsurface irrigation. This cesspool is about 200 feet from the wells. There are no other houses within 500 feet of the supply but all of the houses in the village are provided with either privies or cesspools as no sewerage system has been installed.

From the recent inspection it appears that the previous recommendations of this Department have been partly acted upon, in that a subsurface irrigation system has been installed to take care of the waste products from the nearest house, that the privy nearby has been abandoned, and that analyses of the water have been made yearly.

The results of the analyses of samples of the water taken at the time of the inspection showed a water clear, colorless, and very soft. The figures for nitrogen in its various forms with the exception of nitrates and for oxygen consumed were low, and indicated the presence of small accounts only of decomposing and decomposable organic matter. The value for nitrates was very high, indicating that considerble pollution had reached the supply but has been oxidized and rendered inactive by the natural process of purification in passing through the soil. The total bacterial counts were low, and the absence of organisms of the colon type indicated that the supply was free from active and dangerous contamination at the time of the inspection.

As a result of the reinspection of the public water supply of Easthampton it was concluded that the water supply at the time of the inspection was found to be of a reasonably satisfactory physical and sanitary quality, and accordingly recommended that the authorities continue their careful supervision of the supply.

EAST WORCESTER

A reinspection of the water supply of the village of East Worcester was made on July 15, 1920 by Mr. Earl Devendorf, assistant engineer. Previous inspections of this supply were made by this Department in 1910, 1915, and 1917, the reports upon which are published in the Annual Reports of the Department for the respective years.

The public water supply of the village, owned by the East Worcester Water Company, is derived from Oak creek, the intake being located about one mile north of the village. The village has a population of about 400, and approximately 75 per cent are furnished with the public water supply. The distribution system consists of approximately 2 miles of castiron mains varying in size from 4 to 6 inches in diameter. There are about 100 service taps. The total consumption is estimated at 90,000 to 100,000 gallons per 24 hours. The supply is filtered through a pressure mechanical filter located about one-fourth mile below the intake, this filter with the above estimated consumption, being operated at a rate of about 45,000,000 gallons per acre per day. In view of the fact that no storage is provided in the village, the above rate is undoubtedly doubled at times of maximum demand.

At the time of the inspection the alum pot at the filter plant was shut off and no alum was being supplied to the water. The superintendent stated that it had been shut off some 3 days previous with the idea that the complaints of objectionable tastes and odors might possibly originate from the application of the alum. The operator stated that normally he applies approximately 60 pounds of alum per batch, and that during the summer this would last some six weeks and during the winter much longer. At this rate, alum was being applied during the summer at the rate of about 1/10 of a grain per gallon, an entirely insufficient amount to give any satisfactory coagulation.

The conditions on the watershed are approximately the same as those described in the former reports, with the exception that all of the ponds except Bear Swamp pond have disappeared due to the washing out of the dams. The diverting wall at the north end of the reservoir was not tight and allowed brook water to enter the reservoir at this point. The intake well at the reservoir had been cleaned out during the week previous to the inspection.

On the day of the inspection the engineer examined the water drawn from the tap at the residence of Mr. George Jennings and Mr. James O. Van Buren, when a very pronounced fishy taste and odor was detected. Mr. Van Buren stated that the fishy taste and odors were first noticed during the last week in June. In the reservoir, which is approximately 250 feet in diameter and 10 feet in average depth, and contains some 3½ million gallons of water, algae were found which were mainly spirogira, an organism easily susceptible to treatment by copper sulphate. The engineer at the time of the inspection advised the superintendent to treat the reservoir with not more than 4 pounds of copper sulphate, or at the rate of 1.2 pounds per million gallons, and repeat if necessary until the algae had disappeared. The reservoir is said to contain trout, and care should be exercised in the application of the copper sulphate as trout are easily killed by this treatment. In general, it would be advisable to start early in the year with the application of the copper sulphate in order to prevent the growth of the algae rather than to wait until the growth appears before the treatment is begun.

At the time of the inspection, samples of water were collected and sent to the Division of Laboratories and Research for analysis. The results of these analyses show a moderately hard raw water having some color and turbidity. The amount of nitrogen in its various forms and the oxygen consumed content are high, indicating the presence of considerable amounts of decomposing and decomposable organic matter. The results of the bacterial examination show high total counts with the presence of organisms of the B. coli type in all of the 10 c.c. and 1 c.c. inoculations, indicating the presence of active contamination at the time of the inspection. The results of the analysis of the filtered water show a reduction in color and the removal of the turbidity. The amount of nitrogen in its various forms and the oxygen consumed content is apparently also somewhat reduced by the process of filtration. The alkalinity of the water is not reduced materially by the filter, indicating that the alum was being applied in insufficient amounts. The results of the bacterial analysis of the filtered water show high total counts and the presence of organisms of the B. coli type in inoculations as small as 1/10 c.c., indicating the presence of active contamination in the filtered water being delivered to the consumers in the village.

These results show that the filtration plant was not being operated in an efficient manner, and that alum was not being applied in sufficient quantity. Without the use of an adequate amount of alum, little coagulation is obtained and the proper results cannot be obtained.

As a result of the inspection it was recommended that the East Worcester Water Company immediately carry out the former recommendations of this Department; that alum be applied to the raw water continuously, and in sufficient quantities so that effective coagulation may be obtained for the proper operation of the filter plant; that the filter be carefully operated in order that a safe water may at all times be furnished the consumers; and that the algae growths be prevented by the judicious application of copper sulphate, care being taken in applying the chemical in order not to injure the fish in the reservoir.

ELIZABETHTOWN

A reinspection of the water supply of the unincorporated village of Elizabethtown, as supplied by the Elizabethtown Water Company, was made on September 5, 1919, by Mr. W. J. Erickson, engineering assistant. A previous inspection of this supply was made by this Department in 1915.

Elizabethtown, with a population of 550, is located in the northern part of the town of Elizabethtown, in Essex county. It is about 7 miles west of Westport, which is the nearest railroad station. The water supply is derived from springs located about two miles west of the village. The water from the springs flows either directly to the reservoir or to a small collecting basin formed by a concrete dam across a small brook. From the reservoir it flows by gravity to the consumers through 6 miles of mains varying from 5 to 6 inches in diameter. There is no public sewer system, the method of disposal being privies, septic tanks, and cesspools. There are, however, a few private sewers which discharge into brooks flowing through the village.

The water supply system is derived mainly from five covered springs and a collecting gallery. From these springs and collecting gallery the piping is so arranged as to conduct the water either directly to the storage reservoir or to the small collecting reservoir formed by the damming of the small spring fed brook. The water usually flows directly to the storage reservoir, the excess flowing to the brook reservoir. The gate valve from this brook reservoir was only partly open, it being stated that it was used only at times of drought. It was also stated that in times of heavy rains, or when there is danger of pollution from surface wash, this valve is closed altogether and the supply comes solely from the springs. The watershed tributary to the brook is about one-eighth square mile in area and is uninhabited. A road passes through the gully near the stream and there is a possibility that surface wash may enter the brook from this road. The fence surrounding the brook reservoir and springs was in bad repair. The storage reservoir is of stone masonry and has a timber roof. It is 30 feet by 70 feet by 10 feet deep and has a storage capacity of 125,000 gallons.

From the above facts it was concluded that the springs are apparently free from any permanent sources of pollution and should furnish a safe supply, but that the brook supply is subject to contamination by animals and chance visitors on the watershed.

It was therefore recommended, as previously recommended, that the brook reservoir and springs be fenced by a woven-wire fence so as to exclude all trespassers, that the woods road near the brook reservoir be abandoned, and that the present supervision of the watershed be continued in order to prevent the occurrence of any pollution of the water supply.

ENDICOTT

A reinspection of the public water supply furnished to the villages of Endicott and Union, Broome county, N. Y., by the Endicott Water Works Company which is under the control of Endicott–Johnson Company, was made by Mr. Alfred Mullikin, assistant engineer in this Department, on March 26, 1920, a previous inspection of the supply having been made by this Department in 1916.

Endicott is a village of 15,000 inhabitants, located in the southern part of the town of Union, 8 miles west of Binghamton. Union, with a population of 3,400, is immediately adjacent to the western boundary of Endicott.

The water supply is derived from wells and delivered by pumping through a distributing system consisting of 25 miles of castiron pipe in Endicott and about 5½ miles of castiron pipe in Union. Three steel tanks, each having a capacity of about 1,560,000 gallons, take the surplus and act as equalizing reservoirs.

The wells consist of nineteen 6–inch driven wells, 150 to 200 feet deep, located in the southwestern part of the village, on the northern bank of the Susquehanna river. The water is pumped from the wells by air lifts and flows to the receiving tank, from which it is pumped into the distribution system. The land surrounding the wells is swampy, but drains have been laid which improved the condition to some extent. At the time of the inspection there appeared to be no permanent source of pollution in the immediate vicinity of the wells. The main trunk sewer from the village of Endicott, however, passes within 200 feet of the wells. This sewer is 48 inches in diameter and 20 feet deep. It was said to be of monolithic reinforced concrete construction.

The results of the analyses of samples of water taken on May 11, 1920, showed a water slightly turbid, colorless, and hard. The figures for ammonia were low and indicated the presence of small amounts only of decomposing and decomposable organic matter. The total bacterial count was very high for a well water but the absence of bacteria of the colon type seemed to indicate that the supply was free from active contamination at the time the sample was taken.

As a result of the present inspection it was concluded that the water supply was of relatively satisfactory sanitary quality, and it was accordingly recommended that the authorities in charge of the supply continue to exercise careful supervision over the area in the immediate vicinity of the wells to prevent any pollution of the soil, and to see that at times of high water in the river no surface water enters the wells.

FARMINGDALE

A reinspection of the water supply of the village of Farmingdale was made on June 9, 1920, by Mr. Alfred Mullikin, assistant engineer. A previous inspection of this supply was made by this Department in 1915, the report upon which is published in the Annual Report of the Department for that year.

Farmingdale is located in the southwestern part of the town of Oyster Bay, on the main line of the Long Island railroad, about 32 miles from New York city. The present population is estimated at 2,200 and some 90 per cent are served with the water from the public water supply. The waterworks are owned and operated by the municipality under the direction of the village authorities.

The water supply is derived from three driven wells located in the eastern part of the village along the Long Island railroad tracks, about 1,200 feet east of the depot. From the wells the water is pumped into steel storage tanks and is forced by air pressure through a distributing system of 6½ miles of castiron pipe ranging from 4 to 6 inches in diameter. The average daily water consumption throughout the year is approximately 60,000 gallons per day, or 30 gallons per capita.

Each of the three wells is 45 feet deep. One 8–inch well located east of the plant has a 6–inch suction main and is provided with a brick pit 8½ feet deep and 2½ feet in diameter. The pipes in this pit are water-tight. There is a similar well located in the same relative position west of the plant and which is provided with a brick pit 7 feet deep and 2 feet in diameter. These two pits are provided with conical wooden covers. The two wells are about 150 feet south of the railroad tracks. The third well, located south of the plant, is an 18-inch tile well provided with an 8-inch suction main. The well is provided with a concrete pit 7 feet deep and 3 feet in diameter. The tile extends slightly above the bottom of this pit, which is provided with a concrete slab cover.

The pumping station and wells are located in a sparsely populated area and there appears to be no direct sources of pollution of the water supply, with the exception of the possible surface wash from the railroad track and from a privy east of the pumping station and located about 50 feet from one of the wells. This privy is provided with a concrete vault which is cleaned but once a year. At the time of the inspection the vault needed cleaning. There are three leaching cesspools in the vicinity of the wells which take care of the waste water from the pumping machinery. Two of the cesspools are southwest of the plant and are located about 30 feet from the wells. They are respectively 7 and 8 feet deep and 6 and 8 feet in diameter. The third cesspool is on the east side of the plant and is 7 feet deep and 6 feet in diameter. It is not thought that these cesspools would be sources of pollution unless polluted wash water from the ground surface should at times enter them. The village is not provided with a sewerage system, most of the houses disposing of their sewage by means of privies and cesspools. Practically none of the buildings are located within 500 feet of the wells.

As a result of the above investigation it was recommended that the municipal authorities in charge of the water supply maintain a careful sanitary patrol at all times to detect and eliminate if possible any sources of pollution which may exist; that all privies and cesspools within a distance of 500 feet of the wells and which have not been provided with containers or made impervious be taken care of immediately, to eliminate any possible sources of contamination of the water supply; and that the privy at the pumping plant receive special attention, be immediately and frequently cleaned, and the contents removed to a remote place for disposal.

FISHER'S ISLAND

A reinspection of the water supply of the village of Fisher's Island was made on June 25, 1920, by Mr. Alfred Mullikin, assistant engineer. A previous inspection of this supply was made by this Department in 1915.

Fisher's Island is located about 12 miles northeast of and at the extreme end of Long Island, about 7 miles southeast of New London, Conn. The winter population is estimated at about 400 and the summer population at 2,500. The total population is served with water from the public water supply. The waterworks are owned and operated by the Fisher's Island Water Company.

The water is derived from ponds and pumped to a concrete reservoir 50 feet in diameter and 25 feet deep, having a capacity of 368,000 gallons, from which it is delivered by gravity through a distributing system consisting of some 6 miles of castiron pipe. In general the details of the water system remain as described in the previous report. The only change which has been made since the last previous inspection is the addition of the chlorination apparatus. The ponds from which the supply is taken are two in number, located near the center of the island. The water is pumped into a concrete reservoir located in the western part of the village and flows by gravity to the consumers. There is no inlet or outlet to the ponds. The small pond is about 15 acres in area and contains 70,000,000 gallons of water. It is directly connected by a 10-inch castiron pipe to the large pond, which is three times its area. This pipe is provided with a valve which is only open during the summer, when the consumption is at maximum.

The watershed is about one-fourth of a square mile in area, and the authorities do not allow building construction on the grounds. There is one house some 500 feet or more away from the plant in which the attendant lives. All houses on the island are provided with cesspools having subsurface drainage. Between the two ponds a road extends connecting the eastern and western end of the island. Notices have been posted to prevent trespassers from polluting the supply. Some trouble has been experienced from the growth of algae in the ponds in the summer season, and copper sulphate has been used to kill these organisms.

The water is taken directly from the small pond through an 8-inch pipe which extends about 30 feet into the pond to a point where the water is about 10 or 12 feet deep. This pipe conducts the water into a brick receiving well 10 feet in diameter and about 24 feet deep, from which the pumps draw their supply. The water is chlorinated by a manual control solution feed Wallace and Tiernan chlorinator which was installed in January, 1920. It is set up in the northeast corner of the engine room. The chlorine is applied at the rate of 4.01 pounds per million gallons or about 0.5 p.p.m. A Fairbanks platform scale is used to check the weight of chlorine.

As a result of the reinspection it was concluded that the water supply was apparently of a satisfactory sanitary quality at the time of the inspection, and it was recommended that the water company continue to exercise careful supervision over the watershed area to detect and immediately eliminate sources of pollution, and to carefully operate the plant to secure effective sterilization of the water.

FREEPORT

A reinspection of the public water supply of the village of Freeport was made on May 19, 1920, by Mr. A. Mullikin, assistant engineer, a previous investigation of the supply having been made by this Department in 1915.

Freeport is located in the southern part of the town of Hempstead, about 25 miles from New York city. The summer population is estimated at approximately 15,000 and the winter population at about 12,000. Of the total population about 90 per cent are served with water from the public water supply. The waterworks are owned and operated by the village.

The water supply is derived from six driven wells located in the west central part of the village. From the wells water is pumped into a distribution system consisting of about 28 miles of castiron pipe ranging from 4 to 12 inches in diameter, the surplus going to a steel standpipe 20 feet in diameter and 125 feet high, having a capacity of 300,000 gallons. The average daily water consumption is approximately 504,000 gallons, or 41 gallons per capita.

The six driven wells from which the supply is derived are 10 inches in diameter and range in depth from 45 to 50 feet. They are about 45 feet apart and located west of the pumping station in a low depression about 250 by 500 feet in area, so that the drainage from immediate surroundings flows towards the wells.

The 1920 inspection disclosed the fact that conditions remained practically the same as at the time of the previous inspection, and that the general sanitary conditions in the vicinity of the wells were unsatisfactory.

It was therefore recommended in the report dated August 13, 1920:

> 1. That a complete sewerage system for the village be constructed in accordance with plans approved by this Department, and all cesspools and privies, particularly those in the vicinity of the wells, be abandoned, and the houses which they serve be connected with the sewerage system.
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> 2. That until the sewerage system is constructed, all privies within 500 feet of the wells be provided with water-tight containers, and all cesspools within the same distance be made impervious; and that when cleaned the contents of the cesspools be carefully removed and satisfactorily disposed of in some remote place.

FULTON

A reinspection of the public water supply of the city of Fulton was made by Mr. Earl Devendorf, assistant engineer, on May 13, 1920, previous investigations of this supply having been made by this Department.

The city of Fulton has a population of 13,000 and is located in the southwestern part of Oswego county, on the Oswego river, and about 25 miles north of Syracuse. The public water supply is derived from four dug wells, located from one to two miles south of the city. Wells Nos. 1 and 2 are located near the pumping station, between the Oswego river and the state highway. Wells Nos. 3 and 4 are located approximately 1/2 mile farther south. The water from wells Nos. 2, 3, and 4 flows into well No. 1, from which it is pumped to the distribution system through about 34 miles of mains ranging from 4 to 20 inches in diameter, the excess over consumption going to a concrete standpipe 40 feet in diameter and 100 feet high, which has a capacity of 950,000 gallons. The average daily consumption is approximately 1,000,000 gallons per day.

At the time of the present investigation it was learned that the sewer line at the pumping station has not been replaced, and is constructed of tile pipe and located approximately 50 feet from well No. 1. The casing of well No. 1 has been raised so that it extends about 2 feet above the ground surrounding the well. All of the wells are covered and provided with steel casings, and the ground surrounding the wells graded in such a manner as to prevent any surface wash from entering and causing any direct contamination of the well water. At wells Nos. 3 and 4, however, no fences have been provided, as previously recommended, and cattle were grazing in the field in which the wells are located. The barn buildings near well No. 3 are still in use and have not been removed, as recommended in our former report. The ditch at the foot of the river dike has been cleaned out by the State, and it was stated that no serious floods have occurred to cause the ground surrounding the wells to be inundated. There are no cross connections of auxiliary fire service supplies existing between the public mains and these auxiliary service mains. It was learned that the city is expecting to place a new 16-inch castiron pipe line extending from the pumping station to Broadway, a distance of approximately 9,000 feet. The cost of this improvement is expected to be approximately $75,000. In addition to this new main, it is also expected to replace several 1 1/2- and 2-inch service lines and connect them with other service mains in order to eliminate dead ends.

It was therefore recommended in a report dated June 30, 1920:

1. That the village authorities take immediate steps to carry out the former recommendations of improving the sanitary condition surrounding the wells by replacing the tile sewer line near well No. 1 with castiron pipe and so re-locating it that it will pass as far as possible from well No. 1; by the construction of a new water-tight well for the storage of condenser water from the river, locating this well as far as possible from well No. 1; by fencing in the land surrounding wells Nos. 3 and 4; and by the purchase of the barn buildings near well No. 3 and their abandonment for stabling purposes.
2. That in view of the complicated hydraulic problems connected with a detailed study of the water supply of this city, the city authorities secure a competent engineer to carry out such studies as may be found necessary to secure the final solution of the problem of securing an adequate and safe water supply for the city of Fulton.

GARDEN CITY

A reinspection of the public water supply of the village of Garden City, Nassau county, Long Island, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on June 10, 1920, a previous investigation of the supply having been made by this Division in 1915.

Garden City is a village located in the northern part of the town of Hempstead. The present population is estimated at 5,000, of which all are served with water from the public water supply. The waterworks are owned and operated by the Garden City Water Company.

The water supply is derived from dug and driven wells located about 1/4 of a mile north of the Long Island Railroad station, in a sparsely populated section of the village. From the wells the water is delivered by pumping into the distributing system consisting of some 22 miles of castiron pipe ranging from 4 to 18 inches in diameter. A steel standpipe 30 feet in diameter and 125 feet high, having a capacity of 660,000 gallons is located about 3/4 of a mile northwest of the main pumping station. This standpipe takes the surplus and acts as an equalizing reservoir maintaining an average pressure in the municipality of approximately 60 pounds per square inch. The daily water consumption amounts to 1,250,000 gallons in summer and about 1,000,000 gallons in winter, or 250 gallons per capita and 200 gallons per capita respectively.

Since the previous inspection an additional pumping plant has been added to the supply which is known as Plant No. 3, and was installed in September, 1918. This plant is located at the southwest corner of Cherry

Valley avenue and 13th street. There are three pumping plants in all. No. 1, the main pumping plant, is combined with the electric light plant and is located at the northeast corner of Cherry Valley avenue and 11th street; plant No. 2 is located at the southwest corner of Franklin avenue and 11th street; and plant No. 3 is located as mentioned above. The dug well at plant No. 1 is 50 feet in diameter and 34 feet deep. The depth of water from the surface of the ground at the time of the inspection was 25 feet. There is usually from 8 to 15 feet of water in the well. The water rises 14 feet in three hours, which figures approximately ½ million gallons per day. The well at plant No. 2 is 86 feet deep. This well has a steel casing 6 feet in diameter which extends 52 feet below the surface of the ground. At the bottom of this pit is a concrete floor 4 feet thick. The driven well at plant No. 3 has a 20-inch casing and 16-inch suction pipe which is driven to a depth of 90½ feet. The strata through which these wells pass is sand.

The village contains principally high class suburban residences, and practically all of the houses are connected to the sewerage system. In the vicinity of the wells the territory is sparely settled, and aside from one toilet about 25 feet south of the well which is connected by castiron pipe to the sewerage system, and one toilet 100 feet west of the well connected to the sewerage system by a tile pipe, there is no other evidence of a possible source of pollution of the water supply.

It was therefore recommended in a report dated November 22, 1920:

1. That all sewers within 500 feet of the wells be constructed of cast-iron pipe with lead joints.
2. That a careful sanitary patrol be maintained at all times in the vicinity of the wells in order to detect any possible sources of pollution, and that such possible sources when discovered be immediately eliminated.

GARNERVILLE

An investigation of the public water supply of Garnerville was made by Mr. Earl Devendorf, assistant engineer in this Department, on September 1, 1920.

Garnerville is an unincorporated village of some 400 inhabitants located in the eastern part of Rockland county, one mile west of the West Shore railroad station at West Haverstraw, 35 miles north of New York city. The waterworks are owned and operated by the Rockand Finishing Company.

The supply is derived by gravity from Minisceongo creek, after filtration through mechanical gravity filters and sterilization by means of liquid chlorine. The watershed of the creek above the point of the intake has an area of 18½ square miles. There is sufficient storage upon the watershed to give a minimum dry weather flow of approximately 5,000,000 gallons per day, as estimated by Hill & Ferguson, the consulting engineers. The country is very steep and rocky and for the most part sparsely settled. However, there are numerous houses located near the stream a short distance above the intakes. At Thiells, some 2 miles above the small ice pond from which the supply is taken, the effluent of the sewage disposal plant of the Letchworth Village institution is discharged into the stream.

The disposal plant at the institution, consisting of settling tank and sprinkling filters, settling basin, sludge tank and sludge bed, is at present treating the sewage of some 500 persons. It is contemplated, however, to have an ultimate population of 3,300 inmates at the institution, when the present disposal plant will be enlarged. At the present time arrangements are being made to install a chlorination apparatus for the sterilization of the effluent from the plant. The dilution factor from the sewage effluent being discharged into the stream is at the present time about 75, whereas with the ultimate population it will be approximately 10, as based upon the dry weather flow of the creek.

The water flows by gravity from a small ice pond having a capacity of about four million gallons, located a short distance above the factory of the Rockland Finishing Company, and flows thence by gravity to the coagulation basin and filters, and thence to the clear water well where it is sterilized by means of liquid chlorine. From the clear water well the water is pumped to the distribution system and the excess over consumption is stored in the elevated tank located on the hill south of the factory. The elevated tank has a capacity of 125,000 gallons. The consumption is estimated from speed tests on the pumps as approximately 225,000 gallons, of which 120,000 gallons are used for commercial purpose.

The filter plant consists of mixing tanks and constant head orifices provided in duplicate for the application of alum and soda ash, a coagulation basin having a capacity of 50,000 gallons or approximately 5 hours detention, two gravity mechanical filters installed by the International Filter Company, having a total area of 160 square feet, and a clear well having a capacity of 10,000 gallons. The filter plant is operated on the average of about 11 hours per day. The gauges at the time of the inspection showed a rate of operation of 250,000 gallons per day, or 68,000,000 gallons per acre per day, and a loss of head of approximately 8 feet. The beds are washed with filtered water once each day. The first filtrate for washing is wasted until clear. As the chemist in charge of the operation of the plant was absent on the day of the inspection, no information as to the percentage of wash water was obtainable. From the caretaker at the plant it was learned that approximately 24 pounds of soda ash and 80 pounds of alum are used each day. With the estimated daily consumption, this is equivalent to .75 grain per gallon of soda ash and 1.86 grains per gallon of alum.

The filtered water is sterilized by means of liquid chlorine as it enters the clear well. A Wallace & Tiernan Co. solution type chlorinator is provided in duplicate, and at the time of the inspection chlorine was being applied at the rate of one pound per 24 hours, or based upon the estimated consumption at a rate of .53 parts per million. Scales are provided for weighing the cylinders of chlorine and daily records are kept to check the operation of the chlorination apparatus. Daily tests are said to be made by the chemist in charge of the operation of the plant. These are said to consist of alkalinity and turbidity readings, total bacterial counts, and presumptive tests for the presence of bacteria of the B. coli type.

At the time of the inspection the matter of cross connection was taken up, and it was ascertained that there were two cross connections between the new distribution system and the mains of the Haverstraw Water Company. These cross connections are provided with double check and gate valves and drains, and are located in accessible pits or manholes in accordance with the plans approved by this Department for such cross connections.

As a result of the investigation, it was concluded that the former public water supply of Garnerville as furnished by the Haverstraw Water Company is not being used at present; that the water supply of Garnerville now being used is furnished by the Rockland Finishing Company; that Minisceongo creek, from which this water supply is derived, is subject to both direct and indirect pollution from a populated watershed, and in addition receives at present the unsterilized effluent from the disposal plant at Letchworth Village, situated at a distance of some two miles above the point of intake; that the public water supply is treated by means of a modern purification plant recently installed by the Rockland Finishing Company; and that at the time of the inspection the filtration and chlorination plants were being operated in an effective manner and were producing a water of satisfactory sanitary quality.

In view of the above facts it was recommended, in a report dated October 8, 1920, that the officials in charge of the purification plant continue to operate the same in a careful and effective manner, and make daily analyses of the raw and treated water for the purpose of controlling the operation of the plant in order that the production of a water of satisfactory sanitary quality may at all times be assured.

GLEN COVE

A reinspection of the public water supply of the city of Glen Cove, Nassau county, was made by Mr. Alfred Mullikin, assistant engineer, on June 14, 1920, a previous inspection of this supply having been made in 1913.

Glen Cove is located about 28 miles from New York city, in the northwestern part of the town of Oyster Bay. The present population is estimated at 10,000, of which 75 per cent are served with water from the public water supply. The waterworks are owned and operated by the Nassau County Water Company.

The water supply is obtained from 13 driven wells located in the southern part of the village, about ¼ of a mile southwest of the Glen Street railroad station. The water is pumped from the wells through a 10-inch force main about 1,600 feet long to a standpipe located on a hill. The standpipe is 25 feet in diameter and 120 feet high, having a capacity of 440,000 gallons. This tank takes the surplus and acts as an equalizing reservoir. The average daily water consumption in winter is 400,000 gallons, or 53 gallons per capita, while in the summer the consumption reaches 800,000 gallons per day.

In addition to the seven 10-inch driven wells, six new wells have been driven. Three of these are 6-inch wells from 300 to 350 feet deep, located just east of the pumping station. These three wells at the time of the inspection were under repair, the strainers having been taken out for cleaning. The other three wells are located northeast of the pumping station, 2 of them are 6-inch, 200 feet deep, and one 8-inch, over 450 feet deep. The three last mentioned wells were flowing at the time the inspection was made. The surface of the ground near the wells consists of sand and gravel. It is understood, however, that the deep 8-inch well passed through two clay strata before reaching the stratum from which its water is derived. The water company intends to drive three more 8-inch wells in the immediate vicinity.

The tops of the casings of the old wells enter brick cisterns fitted with wooden covers. These cisterns are provided with connections near the top which take care of the overflow from the wells when the pumps are not operating. The six new wells are not provided with cisterns. The casings of these wells, however, extend several feet above the ground.

Some 300 or 400 feet east and north of the pumping station and on a higher elevation, the village is thickly populated. A domestic sewerage system was constructed in the village in 1913 but apparently only about 50 per cent of the population are connected to the sewer system.

In a report on the previous inspection it was recommended that the covers over the cisterns be made to fit tight and be kept locked, but from the recent inspection it appears that these covers have not been securely fastened and locked.

It was therefore recommended in a report dated August 31, 1920, that the water company maintain at all times a careful sanitary patrol over the area in the vicinity of the wells, and that the water cisterns be properly covered and fastened to prevent accidental pollution.

GLENS FALLS

A reinspection of the public water supply of the city of Glens Falls was made by Mr. W. J. Erickson, sanitary inspector, on August 4, 1920, previous inspections having been made in 1910 and 1915.

Glens Falls is a city of about 16,500 inhabitants, located in Warren county, 60 miles north of Albany on the Hudson river. The water supply is derived from three catchment areas on the slopes of the Luzerne mountains, about 6 miles northwest of the city. The water collected from these areas is impounded in three storage reservoirs, from which it flows by gravity to the city through two mains, one 12 inches in diameter and the other 20 inches in diameter. An emergency supply is obtained by pumping from Halfway brook. The distributing system consists of 29.94 miles of castiron mains. The total consumption is estimated at about 3,000,000 gallons daily, or 180 gallons per capita per day. The water system is owned by the city and is under the direction of the board of water commissioners.

The three watersheds from which the regular supply is obtained are all adjacent to each other. The two northerly ones drain into the Halfway brook and thence northeasterly into Lake Champlain, while the most southerly one drains into the Hudson river.

The northerly watershed is known as the Butler pond watershed. The supply is derived mainly from a shallow, swampy pond known as Butler pond, which is about three-quarters of a mile long and comparatively narrow. At the time of the inspection the water level was low and the bottom in the shallower portion was exposed. There was considerable decomposing vegetable matter in the pond, especially at the lower end, where the water had a fairly high color. From the outlet pipe of the pond the water flows in a natural turbulent mountain stream to the storage reservoir about a mile and a half below. This storage reservoir is formed by an earthen dam with a concrete corewall some 60 feet high, forming a reservoir of 130,000,000 gallons capacity. Several hundred feet below this dam is a small concrete distributing basin from which the supply is conducted in a 12-inch main to what is known as the upper junction, where the pipes from the three reservoirs meet.

The watershed of the Butler Pond creek, as it is called, is mostly wooded, hilly country with only a small portion under cultivation. The city has purchased considerable of the land on this as well as on the other watersheds and is reforesting them with white pine and spruce. Two farms on the Butler Pond watershed have been recently purchased by the city. Previous to this, however, they were provided with chemical closets by the city. There are now apparently no permanent sources of pollution on the watershed.

The central or the Wilkie watershed is developed by the construction of an earthen dam at the head waters of the stream. This dam forms a reservoir of about 55,000,000 gallons capacity and has an average depth of about 10 feet. The watershed above the reservoir is entirely wooded. The edges of the reservoir have been cleaned and are kept free from driftwood. The distributing reservoir is about 2 miles below the storage reservoir, from which the water is conducted to the junction with the mains from the other reservoirs through two 12-inch castiron mains. The distributing reservoir was working at the time of the inspection and the water was highly colored. The watershed is similar to that of the Butler watershed. A wood road, on which two lumber camps are located, passes along the stream to the storage reservoir. It was stated that no lumbering has been carried on during the past year. When these camps are used the city furnishes them with chemical closets and chemicals which are kept for that purpose.

The southerly reservoir is known as the Keenan reservoir. It is developed by an earthen dam which forms a reservoir of about 200,000,000 gallons capacity and floods an area of some 65 acres. The water flows over a rocky bed to a concrete distributing reservoir about a mile below the dam. Two small settling basins have been made along the stream by the construction of small masonry dams. From the distributing reservoir the water flows to the before-mentioned junction, from which the combined flow is conducted to the city through a 12-inch concrete-lined pipe and a 20-inch castiron main.

There are no permanent sources of pollution on this watershed though it is subject to some pollution, as is true of all three, from trespassers on the watershed. A road passes along the course of the stream, but is on the property of the city and it is planned to have this road abandoned. At present lumber is being hauled daily down this road.

All the reservoirs are being kept in a clean condition and the watershed is being cleaned and being reforested. Warnings have been posted on all watersheds.

The auxiliary supply has been developed by the construction of a small wooden diverting dam across the Halfway brook about 1 mile northwest of the city. The water flows from this diverting dam to a small concrete suction basin from which it is lifted by a pumping plant and discharged into the mains,

The watershed tributary to the Halfway brook above the auxiliary intake is about 4.6 square miles in area. About 25 houses are located on this area, with a total population of about 100, or about 26 per square mile. The headwaters of the stream rise in the slopes of the Luzerne mountains, which are rugged and practically uninhabited. The Wilkie reservoirs are located on this portion of the watershed. The lower section of the stream flows through a flat farming and grazing section. About half a mile above the intake is a farm that is in an insanitary condition. Cows were being pastured in the field above the intake dam at the time of the inspection. Although no thorough inspection was made, it was evident that there is considerable opportunities for contamination from the pasturing of cattle along the stream and from chance visitors as well as the permanent residents on the watershed. On account of these possibilities for contamination of this supply it should not be delivered to the consumers without adequate sterilization.

It was, therefore, recommended in a report dated September 2, 1920, that the board of water commissioners install and carefully operate proper apparatus for the sterilization of all water delivered to the consumers in order to eliminate as far as possible the danger from accidental contamination, and that the board of water commissioners consider the installation of a filtration plant for the treatment of part or all of the supply, the same to be supplemented by aeration in order to remove the odors.

GOSHEN

A reinspection of the public water supply of the village of Goshen was made on August 12, 1920, by Mr. W. J. Erickson, sanitary inspector, previous inspections having been made by the Department in 1912 and 1915.

Goshen is an incorporated village located in the central part of Orange county, about 7 miles southeast of Middletown. Practically all of the 3,500 inhabitants of the village use water from the public supply. Many families use private wells for their drinking water supply on account of the bad taste and odors in the village supply. The waterworks are owned by the village and are under the direction of a board of water commissioners.

The water supply is derived from a small artificial lake known as Prospect lake, which is formed by a dam across a small tributary of the Wallkill river, about 1¼ miles south of the village. From this reservoir the water flows to the consumers through castiron and concrete pipes.

The village has had difficulty in obtaining a sufficient water supply from the present reservoir and has retained the services of consulting engineers to help them in remedying this condition. Mr. J. H. Fuertes, consulting engineer of New York city, presented a report in 1901, which concluded that the disagreeable tastes and odors were due to the drawing down of the reservoir, thus reducing the depth and even uncovering the bottom of the shallower portion which when exposed to the summer sun become covered with algae growths. He suggested a dam below these shallow portions which would keep this area covered at times of low water. He also concluded that the lack of sufficient water supply was due to the fact that the present system had been outgrown and that there was excessive waste through leakage in the water mains and from an abnormal rate of consumption. His other conclusions concerned the adoption of a new or additional supply.

In 1918 the village employed Mr. Ralph N. Wheeler, consulting engineer of New York. He recommended that the Burell tract, a small catchment area tributary to the reservoir, be further developed so as to obtain the maximum yield, and that the consumers be advised of the necessity of curtailing the consumption.

The reservoir, which has a normal capacity of about 110,000,000 gallons, was 8 inches above high-water mark at the time of the present investigation.

Although some algae were noticed at the lower end, they were not present in excessive amounts. The water in the reservoir was highly colored, and there was a distinct disagreeable odor noticeable from the water at the taps in the village. About a month ago the water in the reservoir was treated with copper sulphate. A small catchment area known as the Burell tract has been developed, and the water from this area is conducted to the reservoir by a 12-inch tile pipe.

There are five houses with a population of about 20 people on the watershed which has an area of 2 square miles. Only one of these houses is located on the watershed and the drainage from the barns and outhouses is away from the lake and onto another watershed.

Fishing is allowed on the reservoir by a permit issued by the water board. A general survey has been conducted to discover leaks in the pipe lines, and although there is still considerable waste, it has been materially reduced by the repair of the mains.

It was therefore recommended, in a report dated September 14, 1920:

1. That consideration be given to Mr. Fuertes' and Mr. Wheeler's reports, particularly those recommendations which deal with the conservation and development of the present supply and the development of a new additional supply.
2. That the reservoir be cleaned of organic growths and deepened in the shallower sections to minimize these growths.
3. That copper sulphate be systematically applied under proper supervision in order to prevent algae growths from developing.
4. That regular and frequent inspections be made of the watershed in order to detect and prevent any contamination of the water supply.
5. That no fishing be allowed on the reservoir.
6. That should difficulty be experienced in the carrying out of recommendations 4 and 5, the village authorities apply to this Department for the enactment of rules and regulations for the protection of the public water supply of the village of Goshen.

GOSHEN (High School and Public School)

An investigation of the proposed source of water supply for the High School and Public School at Goshen, N. Y., was made by Mr. W. J. Erickson, sanitary inspector of this Department, on August 19, 1920.

The High School building is located in the southeastern part of the village, on the west corner of Main and Erie streets, and the Grammar School about 500 feet northwest of the High School on the opposite side of Webster avenue. The total attendance of the two schools is about 600. For a year and a half prior to the time of the inspection there had been no drinking water at the schools because the fixtures from which it would be taken are shut off from the village supply on account of the disagreeable tastes and odors and the pupils have obtained their water from wells in the vicinity, all of which are unsatisfactorily located in the built-up portion of the village.

As a result of the inspection it was concluded that a water supply for drinking purposes at the schools, derived from shallow wells on the school property, would without question be unsatisfactory; that a supply derived from deep wells on the property might prove satisfactory, although the location of the property in the built-up section of the village would make it necessary to carefully and continuously watch the quality of the water for the presence of contamination, and also make it necessary to fence off a considerable area around the well, on which it would be necessary to prohibit trespassing of any kind; and that the use of water from the village supply would probably be the safest from a sanitary point of view, even though its use might be undesirable from an aesthetic viewpoint.

The filtering of the village supply would undoubtedly improve its quality to some extent but would probably not entirely eliminate the tastes and odors, even if the filter were operated continuously and in a proper manner, It would seem desirable, if the city water is used, that the improvement of its quality be made by those in charge of the water supply rather than by filtration at the schoolhouse, and to this end it would appear advisable that the authorities in charge of the schools use their influence to have the recommendations of our report of September 14, 1920, carried out with as little delay as possible.

GOUVERNEUR

Reinspections of the public water supply of Gouverneur, St. Lawrence county, were made by Mr. Alfred Mullikin, assistant engineer, on January 28, 1920, and on March 18, 1920. Previous investigations of the supply were made by this Department in 1906, 1909, 1916, 1917, 1918, and 1919, and reports on these investigations are in the Annual Reports of this Department for the respective years.

In the reports on the previous inspections it has been pointed out that the water supply of the village, which is derived from the Oswegatchie river, was objectionable, and that it was seriously contaminated by surface drainage and sewage discharged into the river from villages and hamlets located above the waterworks intake. Serious outbreaks of typhoid fever have also been attributed to the use of this water supply.

Pending the introduction of a new supply from another source, the village has purchased two Wallace & Tiernan chlorine apparatuses of the solution-feed type, which were put in operation about February 18, 1920. One chlorine apparatus is connected with each of the two suction mains. The general features of the present supply, except the chlorination plants, such as the pumping equipment and general arrangements of the system, have already been described in previous reports and will not be reviewed at this time.

At the time of the inspection it was found that although the chlorination apparatuses had been installed and connected up, they were not operating satisfactorily. Both of the devices were clogged and the rubber tubing leading from the solution chambers to the suction mains were stopped, so that very little if any of the chlorine was being applied to the water in the suction mains. The chlorination apparatuses, however, were immediately overhauled and placed in proper operating condition. They were so adjusted as to apply about .6 parts of chlorine per million parts of water treated, which was sufficient to produce a slight blue color by the starch iodide test. Instructions for the care and the operation of the chlorination apparatuses and for the making of starch iodide tests were also left with the operator.

There were seven cases of typhoid fever in the village, and although three of them were in one house and two of them might therefore have been contact cases, the other cases were scattered and would indicate that they were waterborne in their origin. It is significant that chlorine had probably not been properly applied for a considerable time, and that the contaminated river water had consequently been delivered to the consumer with little if any treatment.

It was, therefore, recommended in a report dated April 8, 1920:

1. That the village authorities take steps to provide for a new water supply of satisfactory sanitary and physical quality as soon as possible.
2. That pending the introduction of a new supply, the chlorination plants be operated with as great care and efficiency as possible, and that sufficient chlorine be applied to the water at all times properly to sterilize it.
3. That analyses and tests be made of the water, and daily records be kept as outlined in paragraph 10 of the instructions of the operation of liquid chlorine apparatus.

GREAT BEAR SPRING WATER

An investigation of the bottling of Great Bear Spring Water at Albany, N. Y., was made by Mr. Henry Ryon, assistant engineer in this Department, on August 14 and September 10, 1920.

The water is obtained from springs near Fulton, N. Y., and transported from that place to Albany in glass lined steel tank cars. From these cars it is run directly into the storage tank, and from this tank through the bottling machines into the bottles. It is stated that the storage tank and the piping connected with it are sterilized with live steam at frequent intervals and at least twice a month.

The one-half gallon bottles used for distributing the water when returned to the plant are first washed on the exterior by placing them in a tank of hot water containing revolving brushes, arranged in the shape of a hollow cylinder, which come in contact with the outside of the bottles. They are next taken to the machine for washing the interior, which machine was said to be equipped with a revolving brush and jet for cleaning the inside of the bottles. After being removed from the interior washing machine the bottles are inverted over jets of hot water which rinse the inside, and are then placed in boxes holding six bottles and are ready for refilling. The glass stoppers used in most of these bottles are washed in hot water before being replaced in the bottles. In some cases, however, cork stoppers were used. The corks used were treated with paraffin but not sterilized.

The five-gallon demijohns are treated in practically the same manner as the bottles except that the exteriors are washed by hand. A machine equipped with a rapidly revolving brush is provided for washing the inside of the demijohns, and a jet similar to these used for washing the two-gallon bottles is provided for washing the interior of the five-gallon demijohns. The demijohns are all provided with cork stoppers which were paraffined but not sterilized before being placed in the demijohns. The washing is done with city water which is heated by being passed through coil heaters in the bottling room. At the time of the inspection the temperature of this water was such that it could be easily borne by the hand. When the first inspection of the plant was made. the steam sterilizer provided was not being used because, as the superintendent of the plant stated, it had been impossible to secure enough coal to operate it.

The second inspection indicated that several changes were made in the operation of the plant. The machine for washing the inside of the one-half gallon bottles was in place and being used. The steam sterilizer was also in use and it was stated by the attendant that all the bottles and demijohns, the glass stoppers used in the bottles, and the corks used in the five-gallon demijohns and some of the two-gallon bottles, were being sterilized at a temperature of 220° F. before being used. A small incubator had also been provided, and it was stated that samples of the water were being tested daily by the presumptive method for the presence of B. coli.

The five-gallon demijohns are filled by placing them one at a time on a roller conveyor under manually operated single bottling taps provided for the purpose. The corks are placed in them by hand, and the cork and neck of the bottles and the cork covered with a paper seal. The one-half gallon bottles are filled by an automatic machine, which fills a case of six at a time. The glass stoppers or the corks which are used in some of the bottles are placed by hand, and the stoppers and necks of the bottles covered with paper seals similar to those used on the demijohns.

At the time of the first inspection samples of the water were taken from the taps used in filling the half-gallon bottles and five-gallon demijohns at the plant, from two of the five-gallon demijohns as delivered at the Capitol, and from one of the one-half gallon bottles as delivered at the Capitol. The seals of these bottles were unbroken prior to their being opened for taking the samples. A sample was also taken by the chemist of the Division of Laboratories and Research at the office of the Highway Division of the State Engineer's office from a bottle delivered there. Later, on September

20, 1920, after the changes in the operation of the plant outlined above were made, another set of samples was taken from the bottles delivered at the Capitol.

The results of the analyses of samples of the water taken at the time of the inspection in August indicated a moderate count for all samples, and the absence of B. Coli in those taken directly from the bottling taps and from the glass stoppered half-gallon bottles. Colon bacilli were however found in the 1/10 c. c. inoculations in all the samples taken from the five-gallon demijohns, indicating the presence of active contamination, which judging from the result of the inspection of the plant was probably due to carelessness in filling and closing the bottles. The results of the examination of the samples taken from the bottles delivered to the Health Department at the Capitol on September 20, 1920, after certain changes mentioned above were made in the operation of the bottling plant, indicate the absence of B. coli in all the samples tested, and a considerably lower count in the water from the half-gallon bottles. The count in the sample from the five-gallon demijohn was, however, if anything, slightly higher than those in the samples taken in August.

GREEN ISLAND

A reinspection of the public water supply of the village of Green Island was made by assistant engineer, E. S. Chase, on January 29 and February 2, 1920, previous inspections of this supply having been made by this Division in 1917 and 1918.

Green Island, an incorporated village of about 4,500, is located in Albany county, on an island in the Hudson river between the cities of Troy and Watervliet. Practically the entire population, together with some 1,200 additional in the town of Colonie, are served by the public water supply. The waterworks are owned and operated by the Green Island Water Supply Company.

The water supply furnished by this company is derived from an infiltration gallery located on a small island between the village and Troy. An auxiliary supply is derived at times from the Hudson river. From the infiltration gallery the water is pumped upon two units of gravity mechanical filters and the filtered water, after chlorination, is delivered to the village by pumping through a distribution system consisting of 12 miles of cast-iron mains. The average daily water consumption is approximately 360,000 gallons. Storage is provided by a 50,000-gallon clear water basin and by a 500,000-gallon equalizing reservoir.

During the extreme cold weather of the latter part of January and the first of February of the present year, it became necessary to augment the supply from the infiltration gallery by water from the Hudson river. Water from the river was used from January 15 until February 6, except on January 25 to 30. During this time when the supply was augmented by river water the amount of hypochlorite used for sterilization was materially increased, and was applied in such amounts as to give a marked test for excess chlorine, by the ortho-tolidin method, in samples of purified water taken from a tap at the pumping station.

In this connection it should be noted that in December, 1917, and January, 1918, it was found necessary to use the auxiliary river supply for several days, and that subsequent to this use of the river water a severe outbreak of dysentery occurred, followed by about twenty cases of typhoid fever. As a result of the investigation at that time, it was concluded that the outbreaks were due to the use of inadequately purified Hudson river water.

The equipment of the water company is in a poor physical condition and the entire plant needs a complete overhauling. In connection with the infiltration gallery it is very possible that by cleaning its yield would be increased and consequently the necessity for the emergency use of the river would be obviated. This gallery has not been cleaned since 1915, and at that time removal of accumulated silt materially augmented the yield.

The apparatus for chlorinating the supply is of the type used with hypochlorite, and is therefore less easily and satisfactorily operated than modern types of apparatus using liquid chlorine. It is probable that liquid chlorine apparatus could have been so operated at the time of the recent emergency as to have given adequate chlorination without causing taste and odors from an undue excess of chlorine.

The two filters are of the tub type, New York Continental–Jewell manufacture. The coagulation and subsidence occurs in the lower part of the tubs, the subsidence period amounting to about 15 or 20 minutes. As the pumping station is operated for about 8 hours daily, the rate of filtration during the period the filters are in service amounts to 115 million gallons per acre daily. To determine the efficiency of the purification plant weekly analyses are made by James M. Caird of Troy.

It was therefore recommended, in a report dated February 27, 1920, that the water company continue to operate the purification plant with care and efficiency; that the company investigate the possibility of increasing the yield from the infiltration gallery, either by cleaning, or possibly by increasing its length; and that, as previously recommended, liquid chlorine apparatus be substituted for the hypochlorite plant.

GREENPORT

A reinspection of the public water supply of the village of Greenport, Suffolk county, was made by Mr. Earl Devendorf, assistant engineer, on November 6, 1919, a previous inspection having been made by this Department in 1916.

Greenport is an incorporated village in the northeasterly part of Suffolk county, N. Y. The population consists of approximately 3,800 inhabitants. The water supply is derived by pumping from one new and four old dug wells west of the village. The daily consumption amounts to from 500,000 to 750,000 gallons, or 125 to 175 gallons per capita.

The recent inspection disclosed that conditions of the water supply have been changed in certain particulars since the time of the previous inspection. The supply has been augmented by the construction of a new dug well some 1,600 feet north of the old pumping station. The privy at the old pumping station has not been removed and an inspection showed the vault to be filled. This privy is located within 75 feet of the nearest well. The privy at the nearest house, some 400 feet east of the pumping station, has been moved to the farther side of the lot. In other respects the condition of the public water supply remains practically as before.

The new well is located near the highway, and is a dug well 15 feet in diameter and 30 feet in depth. Normally there is 16 feet of water in the well, but when pumping is started the surface of the water is lowered about 8 feet within an hour. The well is apparently free from sources of pollution with the possible exception of drainage from the highway. There are no houses within one-quarter of a mile of this well. At the time of the inspection the well was provided with a wooden curb and cover to prevent surface wash from entering. Water was first pumped from the well into the village distribution system about October 1, 1919.

A sample of water was collected from the new well and forwarded to the Division of Laboratories and Research for analysis. The results of the analysis follow:

Color	0	Oxygen consumed	1.6
Odor, hot	none	Chlorine	75.
Odor, cold	none	Hardness	45.7
Turbidity	0	Alkalinity	21.
Ammonia free	.070	Bacteria per c. c.	14,000
Ammonia alb.	.018	B. coli, 10 c. c.	3+0—
Nitrites	trace	B. coli, 1 c. c.	3+0—
Nitrates	.200	B. coli, 1/10 c. c.	2+1—

The results of this analysis showed a water clear, colorless, free from odor, and moderately hard. The somewhat high figures for free and albuminoid ammonia indicate the presence of moderate amounts of decomposing and decomposable organic matter. The results of the bacterial examination show a veiy high total count, and the presence of organisms of the B. coli type in nearly all of the inoculations examined indicated the presence of active contamination. This may in part be due to the fact that the well has been dug only recently and that the contamination from workmen incidental to construction had not entirely disappeared. Other analyses should be made, and if the results still show the presence of contamination, this source of supply should either be abandoned or sterilized before being pumped into the distribution system for public consumption The high chlorine contents of both well supplies are probably due to the influence of sea water.

In view of the above, it was recommended in a report dated March 3, 1920, that as previously recommended the privy at the pumping station be provided with a removable container, and a sanitary patrol be exercised to keep all the privies within a radius of 500 feet in a clean and sanitary condition; and that other analyses be made of the new well supply in order to determine if the contamination indicated by the recent analysis is permanent or temporary, and if permanent the supply should be first sterilized before being pumped into the village distribution system.

A second reinspection of the public water supply of the village of Greenport, Suffolk county, was made on June 7, 1920, by Mr. Alfred Mullikin, assistant engineer.

This inspection disclosed the fact that the privy located about 75 feet from the nearest well has not been removed and is in an insanitary condition but that the privy at the nearest house some 400 feet east has been removed about 300 feet farther east. In a report dated July 6, 1920, the following recommendations were made:

1. That the municipal authorities in charge of the water supply carry out at once such of our previous recommendations as have not as yet been acted upon: namely, that the privy at the pumping station and all other privies within 500 feet of any of the wells be provided with removable watertight containers and kept in a satisfactory condition, and that a sanitary patrol be maintained by the village authorities to make certain that the privies are always kept in a satisfactory condition.
2. That occasional analysis throughout the year be made of both sources of supply in order to determine whether or not the degree of pollution of the ground water is increasing and to detect any active pollution if present.
3. That should active contamination be at any time detected, the source be immediately determined and removed, or the contaminated well be abandoned, or the water supply properly chlorinated.
4. That the curbing of the old wells be raised and cemented to prevent the entrance of surface wash.
5. That the oil and waste water pit be abandoned, the water being carried off by extending a pipe line in the southern direction.

GREENWICH

A reinspection of the sanitary condition of the public water supply of the village of Greenwich was made by W. J. Erickson, engineering assistant, on December 12, 1919, a previous inspection having been made by this Department in 1912.

Greenwich is a village located in the southwestern part of Washington county. It occupies both banks of the Batten kill and is about 30 miles north of Troy. It has a population of about 2,700 of which 2,000 are served by the water supply. The waterworks are owned and operated by the Greenwich Water Company. The original waterworks consisted of a gravity supply from a reservoir formed by the damming of a small brook located about

2 miles north of the village. This reservoir is now used only for fire protection. The present main supply was developed about 25 years ago when a dam was constructed on Fly creek between Archdale and Easton station, about 3½ miles south of the village. From the reservoir formed by this dam the supply flows by gravity to the distribution system. An auxiliary supply is derived by pumping from the Batten kill, in the eastern part of the village.

Fly creek rises just north of Fly Summit, and flowing northerly empties into the Batten kill at Greenwich. The main tributary rises east of Cambridge and joins the Fly creek just above the reservoir. The total drainage area is about 6.0 square miles, on which there is a total population of about 250, or 42 per square mile. The Greenwich and Johnsonville railroad crosses the main stream at several points. Near the headwaters of the creek is the small hamlet of Fly Summit, with about 100 inhabitants. There are no direct sources of human pollution at this point, although the meadows adjacent to the stream are used for pasture as is most of the meadow land all along the stream. Below Fly Summit and about ¾ of a mile above the reservoir, is Archdale. There are several houses at this point, but they are about 300 feet from the stream. On the main tributary, which rises near North Cambridge, about one mile from the reservoir, is a small pond located on the farm of B. F. Waters. This pond is fenced and is used solely for ice cutting, and is said to be dry during the summer months. Care is taken to remove droppings from the ice, and the pond is protected by means of a wire fence. The farm yard extends to the edge of the pond and a manure pile was noticed about 100 feet from it. The privy is located about 250 feet from the pond. The watershed area of this stream is essentially the same as that of the main stream, flowing through cultivated pasture land.

The Batten kill has a drainage area of about 400 square miles, most of which consists of a sparsely populated farming region. The domestic and trade wastes from the villages have brought about a considerable pollution of the Batten kill. The stream is used at times of drought as an auxiliary to the regular supply. When used, this supply is sterilized with hypochlorite of lime. It is said that a measure full of the powder is added to a wooden vat and the resultant solution is fed to the intake pipe. No definite amount or rate of application could be obtained.

At the time of the inspection samples of water were collected from the Fly creek reservoir and from a tap in the village. The results of the analyses of these samples made by the Division of Laboratories and Research follow:

Fly Brook Reservoir

Color	10	Chlorine		1.6
Turbidity	0	Hardness, total		68.6
Ammonia, free	.012	Alkalinity		47.
Ammonia, alb.	.068	Bacteria per c. c.		1700
Nitrites	trace	B. coli type	10 c. c.	3+0—
Nitrates	.500		1 c. c.	3+0—
Oxygen consumed	3.7		1/10 c. c.	0+3—

Tap in Village

Bacteria per c. c.		1200
B. coli type	10 c. c.	3+0—
	1 c. c.	2+0—
	1/10 c. c.	1+2—

As a result of the inspection it was concluded that the water supply as derived both from the main and auxiliary sources was not of satisfactory sanitary quality for human consumption without proper treatment, and it was, therefore, recommended, in a report dated January 17, 1920:

1. That owing to the inadequacy and unsatisfactory quality of Fly creek as a source of public water supply, the water company consider the development of a new and adequate supply of satisfactory sanitary quality.

2. That should the Fly creek be retained as a main or auxiliary supply, the supply be subjected to some modern method of filtration, supplemented by chlorination.

3. That pending the carrying out of the above recommendations the water company install and properly operate apparatus for sterilization with liquid chlorine of both the present sources of supply.

4. That the officials of the water company cause frequent and careful inspection to be made of all parts of the watersheds used for public supply in order to detect and minimize the opportunities for dangerous pollution of the supply.

GUILFORD

A reinspection of the water supply of the village of Guilford was made by Mr. Alfred Mullikin, assistant engineer, on February 3, 1920, a previous inspection having been made by this Division in 1915.

Guilford is an unincorporated village with a population of about 350, located in the town of Guilford, Chenango county, 9 miles northwest of the village of Sidney.

The water supply is owned and controlled by the Moses Brothers' Water Company, and is derived, without purification, directly from a mill pond approximately 75 feet wide and 200 feet long, situated just below and adjacent to the outlet of Guilford lake.

Guilford lake has a drainage area of about 1¾ square miles and a water surface area of about 73 acres. The lake is fed by two small streams at the west end and by one from the north end, the latter being the larger of the three. There are also numerous springs in the bottom of the lake which probably constitute the main source of supply.

Paralleling the entire west shore line, about 50 or 60 feet from the water edge of Guilford lake, is the New York, Ontario and Western railroad. Between the railroad and the bank of the lake is a public highway. The lake is used extensively for boating, bathing, fishing, and ice cutting, all of which uses increase the unsatisfactory condition of this water for drinking purposes due to accidental, incidental, or willful pollution. Trouble is also experienced due to algae at certain seasons of the year resulting in disagreeable tastes and odors in the supply. There are about 14 cottages in close proximity to the lake, and in summer numerous campers occupy the shores. Four boathouses are located on the lake near the outlet back of the dam.

This dam is located directly underneath a highway bridge, and considerable surface debris falls through the wooden flooring. As the water enters the mill pond a large amount of churning of mud on the bottom of the pond is effected, requiring a long while for the turbidity to settle out. On the east bank, about 25 feet from the mill pond, is a public highway. Just before reaching the bridge between the highway and the mill pond is the Sheffield Company's ice house. Every night, in winter, from 12 to 20 teams congregate about the ice house for hauling away the ice. Manure therefore may be easily washed into the mill pond. On the west bank, which is steep, the New York, Ontario and Western railroad passes within 25 feet of the water's edge. It is evident that surface wash from the highway from the vicinity of the ice house, from the bridge and the railroad, together with the sudden stirring up of mud by the influx of water from Guilford lake to the mill pond, brings about considerable pollution of the water supply.

It was therefore recommended in a report dated March 1, 1920:

1. That the owners of the water supply take immediate steps to furnish a supply of unquestionable sanitary quality.

2. That the intake be placed in the lake itself, as previously recommended, and sterilization apparatus be installed and properly operated for the purification of the lake water.

3. That consideration be given to the installation of a modern filtration plant.
4. That the services of a sanitary engineer be secured to make a study of the problem and advise as to the most economical methods by which the improvements may be carried out.

HAMDEN

A reinspection of the public water supply of the village of Hamden was made by Mr. Earl Devendorf, assistant engineer, on September 26, 1919, previous investigations having been made by this Department in 1908 and 1915.

Hamden is an unincorporated village in the town of Hamden, Delaware county, located on the western branch of the Delaware river. The resident population is about 350, all of which are supplied with the public water supply. The waterworks are owned and operated by Mr. Howard D. Youmans of Delhi, N. Y.

The public water supply is derived from a reservoir located on Launt Hollow brook, about one-half mile north of the village. From this reservoir the water is distributed by gravity to the village.

The watershed of Launt Hollow above the reservoir has a drainage area of about 4 square miles, with a total population of 50 inhabitants. The topography of the country is rather steep and the land is devoted to farming and agricultural purposes.

The previous reports recommended that the existing sources of pollution on the watershed be removed and that the supply be sterilized with liquid chlorine, or a new supply of unquestionable quality be developed.

At the time of the recent inspection the watershed was inspected and a number of sources of contamination noted. Also, samples of water were collected and sent to the Division of Laboratories and Research for analysis, the results of which follow:

Intake Overflow

Color	5	Chlorine	1.4
Turbidity	Tr.	Hardness, total	24.7
Ammonia, free	.002	Alkalinity	24.
Ammonia, alb.	.098	Bacteria per c. c.	67500
Nitrites	.003	B. coli type. 10 c. c.	3+ 0—
Nitrates	.020	B. coli type. 1 c. c.	3+10—
Oxygen consumed	3.0	B. coli type. 1/10 c. c.	3+ 0—

Tap Public Supply

Bacteria per c. c.		88000
B. coli type	10 c. c.	3+0—
	1 c. c.	3+0—
	1/10 c. c.	0+3—

These results show the water to be a soft water having some color and turbidity. The decomposing and decomposable organic matter content is rather high, and the chlorine content is also above the normal for unpolluted surface waters in this locality. The results of the bacterial examination show excessive total counts and the presence of organisms of the B. coli type in all of the 10 and 1 c. c. inoculations examined, indicating the presence of active and potentially dangerous contamination of animal or human origin.

As a result of this investigation it was concluded that none of the former recommendations of this Department have been carried out, and that as shown by the survey of the watershed and the results of the analyses the supply is subject to serious contamination and unsafe for domestic uses.

It was therefore recommended that the owner carry out the former recommendations of this Department as summarized above, or secure a new supply of unquestionable quality.

HAMMONDSPORT

A reinspection of the public water supply of the village of Hammondsport, Steuben county, N. Y., was made by Mr. Henry Ryon, assistant engineer in this Department, on January 23, 1920, previous investigations of this supply having been made in 1911 and 1914.

The village of Hammondsport is located in the northeastern part of Steuben county, at the extreme southerly end of Lake Keuka. As near as could be estimated the population is about 1,500. The waterworks are owned by the village and under the control of a water board. At the present time the source of supply is Keuka lake. The water board is, however, considering the development of a new supply to be derived from wells.

The conditions at the time of the present inspection were practically the same as at the time of the 1914 investigation. The water is taken from the west side of Keuka lake at the pumping station located about one-half mile north of the village. The intake or suction line from the pump is a 5-inch steel pipe, said to be about 250 feet long and to extend out into the lake to a point where the water is about 60 feet deep.

The lake, and Keuka inlet and Glenn brook, two streams which discharge into the lake at Hammondsport, all receive the surface wash from a thickly populated area, and a considerable quantity of polluted matter is undoubtedly carried into the lake from this source. There are boathouses and other buildings along the edge of the lake, and in the summer the lake is used for bathing and boating which make it probable that accidental or willful pollution of the water frequently takes place. The village has no sewerage system; many of the houses have privies, and the others are provided with cesspools the contents of which are said to seep into the ground.

At the present time the village is constructing a new pumping plant on the southern edge of the village near the electric power station with the intention of obtaining part or all of its water supply from wells drilled in that locality.

Three wells have been sunk in the low flat at the head of the lake between the railroad tracks and Keuka inlet, and about 200 feet north of the latter. These wells are a few feet apart and extend through 30 feet of hardpan into a 7-foot stratum of water-bearing gravel. When the wells were first drilled it is understood that they overflowed, but at the present time the water apparently stands a little below the surface of the ground. A test well sunk to a depth of about 100 feet indicated no other water bearing strata. No definite figure as to the yield of the wells is available.

To the north of the wells on the opposite side from the inlet the slope of the ground rises gently toward the central part of the village. There are about 12 houses within 500 feet of the wells, and two privies within 200 feet of them. Most of the houses in the section near the wells are provided with cesspools which it is understood are seldom cleaned, the contents leaching away into the ground. With two or three exceptions the houses are at higher elevations than the ground at the wells. There seems, therefore, to be a possibility that the wells may be polluted by matter from the cesspools and privies in the vicinity. The wells are so located that there is necessarily considerable passing to and fro near them.

In order to develop the wells an inverted steel shell 20 feet in diameter has been placed around them and sunk to a depth of about 13 feet below the surface of the ground. A 12-inch concrete floor has been laid at the bottom of this shell forming a pump well of about 28,000 gallons capacity. The top of the shell extends about three feet above the surface of the ground.

The casings of the wells have been cut off a little above the bottom of the pump well. At the time of the inspection the shell had not been caulked and leaked badly when the well was pumped out, admitting a large quantity of surface water. A pump has been installed in the pump house adjacent to the well for pumping the water into the village mains. This pump is now connected, and it is understood that well water was pumped into the mains for a few hours. The engineer stated, however, that at all other times the water has been discharged through a by-pass into the inlet whenever the pump well has been emptied.

As a result of the inspection it was concluded that the water supply of Hammondsport is still open to serious contamination from surface wash from inhabited areas, excreta and other matters deposited on the shore of the lake, and accidental or willful contamination from boats or steamers plying upon the lake; and that the location of the new wells is not entirely satisfactory because of their closeness to several houses higher than they using cesspool and privies, and the fact that considerable traffic passes near them.

It was therefore recommended, in a report dated February 5, 1920, that so far as possible the village authorities take steps to prevent polluted matter from reaching the lake or the streams leading to it, and that they immediately install suitable apparatus and sterilize by the use of chlorine or hypochlorite of lime all water pumped into the village mains.

HANCOCK

A reinspection of the public water supply of the village of Hancock was made by Mr. W. J. Erickson, engineering assistant, on May 21, 1920, a previous inspection of the supply having been made in 1913.

Hancock, which is an incorporated village of about 1,500, is located in the southern part of Delaware county, at the junction of the east and west branches of the Delaware river. Of the total population, about 1,000 use the public supply, which is owned and operated by the Hancock Water Company.

The regular supply is derived from Bear creek, a small mountain stream impounded by two storage reservoirs northwest of the village. It is distributed from the lower storage reservoir by gravity through a distribution system consisting of castiron pipe varying from 4 to 8 inches in diameter. An auxiliary supply is derived from Sand creek, northwest of the village. This supply is pumped into the distribution system after passing through a slow sand filter. There is no public sewer system — private sewers, cesspools, and privies being in general use.

Bear brook, from which the regular supply is derived, has a watershed area of about two square miles. One hundred acres adjacent to the reservoir and creek are owned by the company.

The valley of Sand creek above the filter plant is about seven miles in length and comparatively narrow between fairly high wooded hills. The population may be estimated at about 250. Farming, with some wood cutting and quarrying on the hillsides, are the principal occupations on the watershed. There are about 50 houses with accompanying outhouses on the watershed. Most of these are provided with outside privies. Practically all the farms are located so that the run off from them drains eventually into the creek. Though conditions have improved somewhat there are many insanitary places on the watershed especially privies which are so located that rains may carry drainage from them into the stream. The filter is very poorly constructed, and it is doubtful if it is efficient in the removal of bacteria. This cannot be demonstrated except by a series of bacterial analyses.

As a result of this reinspection it was concluded that Bear brook should yield a supply of satisfactory sanitary quality if adequately protected from contamination; that Sand creek cannot be considered to be a satisfactory source of supply unless satisfactorily treated either by efficient filtration or sterilization; and that the present filter is of unsatisfactory design.

It was therefore recommended, in a report dated October 7, 1920:

1. That the Hancock Water Company apply to this Department for rules and regulations for the protection of the sanitary quality of the water supply.
2. That pending the enactment of rules the water company take steps to prevent the pollution of the water supply by drainage containing human wastes, and that privies near the watercourse be removed to a safe distance.
3. That the water company employ an expert on water supply engineering to advise them relative to the efficiency of the present filter and if found inefficient to advise them as to its reconstruction or the construction of a satisfactory purification plant so that a safe water supply may be obtained.

HAVERSTRAW

A reinspection of the public water supply of the villages of Haverstraw, West Haverstraw, and Stony Point was made by Mr. Earl Devendorf, assistant engineer in this Department, on September 1, 1920, previous investigations of the supply having been made by this Department in 1909 and 1915.

The public water supply is owned and operated by the Haverstraw Water Company. The supply is derived by gravity from a reservoir supplied by a small stream and artesian wells near Thiells; and by pumping from a 4-million gallon reservoir on Cedar Pond brook, about 2 miles northwest of West Haverstraw. The total population served amounts to some 8,100, divided as follows: Haverstraw, 5,700 inhabitants, of which all are served; West Haverstraw, 2,000 inhabitants, of which about 75 per cent are served; Stony Point, 1,000, of which nearly all are served by this public supply.

The Thiells supply is derived from five flowing wells, a small stream, and numerous springs. The water is collected and stored in three reservoirs, two of 500,000 gallons and one of 3½ million gallons storage capacity. There are some 4 or 5 houses on the watershed, all of which are located well back from the supply with the exception of the caretaker's house, which has a cesspool located some 250 feet west of one of the reservoirs.

The Cedar Pond brook supply is subject to serious pollution from many houses located along the bank of the creek within 2 miles above the point of intake. Above this the entire watershed belongs to the Interstate Park Commission, and is practically uninhabited except during the summer season, when campers and vacationists come to the park and the large pond known as Lake Tiorati at the head of the brook. Fishing and boating are allowed on the lake but bathing in the lake is prohibited. The Park Commission intends the further development of this portion of the park by the erection of more camps, and have purchased the rights of the water company in the waters of this brook and pond. They have, furthermore, entered into an agreement with the Haverstraw Water Company whereby the Park Commission will pay the cost, in excess of $15,000, of the erection of a filter plant for the treatment of the waters of this brook, in return for which the lake would be opened for bathing.

Rules and regulations for the sanitary protection of this supply were enacted by this Department on July 14, 1910, and later amended on April 2, 1915. These rules, while allowing boating and fishing upon the lake and stream to a point within 2 miles above the pumping station, when carried on under strict sanitary supervision, prohibit bathing in the lake until a modern filter plant is installed. The very fact that there are thousands of boys and girls camping and roaming over the park property increases the probability of incidental pollution of the water derived from Cedar Pond brook. It is therefore imperative that the proposed filter plant, consisting of a coagulation basin, slow sand filters, clear well and pump, the plans for which have been prepared by Mr. W. A. Welch, chief engineer of the Park Commission, be installed and put in effective operation at an early date in order to eliminate the possibility of an outbreak of any waterborne disease.

As a result of the inspection it was recommended, in a report dated October 7, 1920:

> 1. That the water company continue their efforts to reduce sources of contamination upon the watershed of the Cedar Pond brook supply, and make frequent and careful inspections of the watershed of the Thiells supply in order to prevent any contamination of this source of supply.
>
> 2. That as previously recommended the water company install a filter plant for the treatment of the Cedar Pond brook supply at as early a date as possible.
>
> 3. That pending the installation of the filter plant, the water company immediately purchase and install a chlorination apparatus for the sterilization of the Cedar Pond brook supply and effectively operate the same.

HEMPSTEAD

A reinspection of the public water supply of the village of Hempstead was made by Mr. Alfred Mullikin, assistant engineer in this Department, on June 10, 1920, previous investigations of this supply having been made by this Division in 1915 and 1918.

Hempstead is located in the north-central part of the town of Hempstead, Nassau county, about 22 miles from New York city. The present population is estimated at 7,500, of which 75 per cent are served with water from the public water supply. The waterworks are owned and operated by the municipality under the direction of the board of trustees. The water supply is derived from 8 shallow wells located about ¼ of a mile northeast of the Long Island Railroad station, in a sparsely populated section of land.

From the wells the water is delivered by pumping through a distribution system consisting of some 30 miles of castiron pipe ranging from 2 to 10 inches in diameter. A steel standpipe located on the north side of the pumping station is 20 feet in diameter and 110 feet high, and has a capacity of 258,000 gallons. The daily water consumption is approximately 600,000 gallons in winter and about 1,250,000 gallons in summer. In general, the details of the waterworks system remain as described in the previous report.

As a result of the reinspection of the public water supply of the village of Hempstead, it was concluded that while the water supply was of a satisfactory sanitary quality at the time of the inspection, there are certain opportunities for serious contamination of the water; that there is a possibility of direct contamination of the water by the entrance of surface wash over the low curbs of the wells and indirect contamination by percolation through the soil of polluting matter from the sewer in the street, the privy 400 feet east of the station, or from the surface of the ground around the wells; and that the authorities in charge of the water supply have not as yet carried out the recommendations of the previous report regarding the elimination of the possibility of such pollution.

It was therefore recommended that the concrete well curbs be raised not less than 3 feet above the level of the present surface of the ground, and that suitable embankments be formed around them to prevent surface water from reaching the concrete work; that the area between and around the wells be maintained in neat condition as a lawn and not used for storage purposes or truck gardening, and that no manure, street sweepings, or other fertilizer be applied to this area; and that the privy at the residence 400 feet east of the station be provided with a water-tight container and kept in a satisfactory sanitary condition at all times, or that the house be connected to the sewerage system and the privy abandoned.

HICKSVILLE

A reinspection of the public water supply of the unincorporated village of Hicksville was made by Mr. Alfred Mullikin, assistant engineer in this Department, on May 28, 1920, previous inspections of this supply having been made by this Division in 1915 and 1918.

Hicksville is located in the western part of the town of Oyster Bay, Nassau county, about 27 miles from New York city. The present population is estimated at 5,000, of which about 50 per cent are served with water from the public water supply. The waterworks are owned and operated by the Nassau County Water Company, of which W. J. Drummond is president.

The water is derived from two driven wells located in the southern part of the village. From the wells the water is delivered by pumping into six steel tanks under air pressure and is then distributed by the pressure of the air to the consumers through a distributing system consisting of some 5 or 6 miles of castiron pipe ranging from 2 to 8 inches in diameter. Six steel water tanks rest upon the ground surface and are 8 feet in diameter and 40 feet long, having a capacity of 15,000 gallons each or a total of 90,000 gallons. Only about 60,000 gallons of this space is available for water storage, one-third of the capacity being allowed for storage of air. There are six similar steel tanks used for the storage of air under a pressure of from 100 to 150 pounds per square inch. Of the 700 service taps, practically all are metered. The daily water consumption amounts to 189,000 gallons, or 76 gallons per capita. In general the details of the waterworks system remained as described in the previous report.

As a result of the reinspection of the public water supply of the village of Hicksville, it was concluded that although the supply was apparently subject to considerable pollution at the time the inspection was made, the polluting matter is largely oxidized, as indicated by the fact that the analyses did not show active contamination of the water supply, and it may be therefore considered to have been one of relatively satisfactory sanitary quality at the time of the inspection; that certain potential sources of pollution exist which may at any time cause active contamination of the supply; and that the authorities in charge of the water supply have not carried out the previous recommendations as set forth in our reports.

It was therefore recommended:

1. That the authorities in charge of the water supply cooperate with the village authorities and carry out at once such of our previous recommendations as have not as yet been acted upon, namely:
    (a) That a suitable sewerage system for properly disposing of the sewage of the village be constructed, and all houses in close proximity of the plant be required to connect to this sewerage system.
    (b) That pending the construction of said sewerage system all privies and cesspools within a distance of 500 feet of the wells be properly taken care of as outlined in the above report.
2. That should analyses of the water at any time indicate the presence of active contamination, apparatus for the effective sterilization of the water with liquid chlorine be immediately installed and the water treated with a proper amount of liquid chlorine, directions for applying which may be obtained from this Department.

HIGHLAND FALLS

An inspection of the recently installed chlorination plant for the treatment of the public water supply furnished by the Citizens' Water Company to the village of Highland Falls was made by Assistant Engineer Earl Devendorf on November 7, 1919. A complete report upon an investigation of this supply was made in 1914 and in 1919.

The water supply of Highland Falls is derived from Buttermilk Falls stream, the intake being located about one mile west of the village center.

The water is distributed to the village by gravity and is now subjected to sterilization with liquid chlorine. The installation of this chlorination plant has been made in accordance with the recommendations of this Department. The plant was installed and first put in operation on September 20, 1919. It consists of a manual control dry feed type apparatus manufactured by the Wallace and Tiernan Company. The chlorine is fed directly into the discharge main from the intake reservoir under a 12-foot head. The rate of flow is estimated at 100,000 gallons per day, although there are no meters to confirm this estimate.

When the plant was first put in operation chlorine was applied at the rate of 1 pound per day for a period of about three weeks. This rate was later increased to 1.5 pounds per day, and this was the rate being used at the time of the inspection. Assuming a flow of 100,000 gallons daily, this rate of application would be equivalent to 1.8 p.p.m. of chlorine. As a sample of water collected from the tap from a house about 1,000 feet below the intake reservoir gave no indication of excess chlorine when tested with starch iodide, it is probable that the rate of flow is considerably greater than that estimated.

Following the inspection, samples of water were collected by the superintendent of the water company at times when different amounts of chlorine were being applied to the water. The results of the analyses of these samples are unfortunately somewhat unsatisfactory, due to the liquefaction of the gelatin plates upon which the examinations for total bacterial counts were made. The examinations for organisms of the B. coli type, however, indicate that the chlorination process was reasonably effective in removing active contamination when an amount equivalent to 2 pounds of chlorine per day was being used.

In view of the above fact, it is evident that the water company has carried out the recommendation of this Department with respect to the installation and operation of the chlorination plant for the sterilization of the supply. It should be pointed out, however, that such apparatus, while safeguarding and improving the sanitary quality of the supply, will effect no appreciable improvement in its physical quality, and for this reason the installation of a modern filtration plant is essential if a supply of satisfactory physical quality is to be obtained. It should also be pointed out that the chlorination plant should be, at all times, carefully and efficiently operated, and to this end it would be advisable for the water company to make regular daily determinations for the presence of excess chlorine in the treated water. The chlorine should be so applied that a faint excess of chlorine should be present in samples taken from the tap nearest the reservoir.

It was therefore recommended, in a report dated February 11, 1920, that the water company carry out such of our other recommendations as have not as yet been acted upon at the earliest possible time, and that they maintain the operation of the chlorination plant in an efficient and satisfactory manner.

HILBURN

A reinspection of the public water supply of Hilburn was made by Mr. W. J. Erickson, engineering assistant in this Department, on June 18, 1920, previous investigations having been made in 1912 and 1915.

Hilburn, which is an incorporated village of 1,000, is located in the western part of Rockland county, about half a mile from the New York–New Jersey state line. The water supply is owned and operated by the Mountain Spring Water Company. About 80 per cent of the population is served by this supply.

The supply is derived from two sources, namely: from a storage reservoir located in the hills three-quarters of a mile west of the village; and from a dug well located on the property of the Ramapo Iron Works.

The upland supply is derived by impounding a small stream tributary to the Ramapo river. The watershed area tributary to the supply is about three-quarters of a square mile. The slopes, which are of granite origin, are precipitous and entirely wooded. There are no permanent sources of pollution on the watershed. Formerly the water from a small stream was piped to the reservoir, but on account of the possibilities of pollution this has been discontinued.

The well supply is derived from a dug well about 45 feet deep and 48 inches in diameter. The casing extends to about 8 feet of the ground surface, above which a concrete curb, mortised to the iron casing, extends to about 2 feet above the ground and has a stone cover to prevent foreign matter from entering the well. The well passes through top soil of sand, then hardpan to water-bearing gravel. It is located between the Ramapo river and the railroad, being about 300 feet from the river and about 100 feet from the railroad. The nearest building is the power plant of the Rockland County Electric Company, in which there are two toilets, located about 100 feet from the well. These toilets are connected by a sewer to a point in the river several hundred feet away from the well and about 10 feet lower than it.

As a result of the inspection it was concluded that though the brook supply is not subject to any permanent sources of pollution, it is subject to accidental or willful pollution from visitors and animals on the watershed; that the brook supply has depreciated as to aesthetic quality by the occurrence of algae and other organic growths in the reservoir; and that the well is unsatisfactorily located and subject to contamination and possibly dangerous pollution.

It was therefore recommended, in a report dated September 27, 1920:

1. That an additional safe and suitable upland supply be secured by the development of other mountain streams near the village to make the use of the well unnecessary.
2. That regular patrols of the watershed tributary to the brook supply be made in order to detect and remove any source of contamination of the supply.
3. That the well supply be abandoned.

HILLVIEW

An inspection of the public water supply of Hillview was made by Engineering Assistant W. J. Erickson on June 4, 1920.

Hillview, a small residential settlement with a population of some 60 people, is located in the town of North Greenbush, Rensselaer county, about one mile south of the city of Rensselaer. The public water supply is owned by the Clinton Heights Spring Water Company, which developed the supply in connection with the improvement of the property. It is leased and operated by the Hillview Improvement Association.

The water is derived from several springs about two miles east of the settlement from which it flows through an open ditch to the intake about one mile below. In addition to the water from the springs, the ditch also receives some water from the overflow from a small pond. From the intake the water was formerly pumped by a windmill into an elevated tank, from which it was delivered by gravity to the consumers. This windmill and tank were burned several years ago and, in their place, the present pump house was built. This house is a substantial brick structure 15 feet square built into the hillside. In it are housed the pump and a pressure tank. The pump is driven by a 3-hp. automatically operated electric motor, and discharges the water into a 2,000-gallon pressure tank. The motor is started when the pressure in the tank gets as low as 30 pounds per square inch and is stopped when the pressure reaches 35 pounds per square inch. In 1916 a new intake was constructed about 300 feet upstream so as to avoid pollution from dwellings located below this point. From this intake the water is conducted to the original intake by an iron pipe.

At the time of the inspection samples of the water were collected and the results of the analyses of these samples made by the Division of Laboratories and Research are as follows:

Color	5	Chlorine	2.2
Turbidity	trace	Hardness, total	215.
Ammonia, free	.004	Alkalinity	188.
Ammonia, alb.	.072	Bacteria per c.c.	1800
Nitrites	.001	B. coli type (10 c.c.)	3+0—
Nitrates	.080	B. coli type (1 c.c.)	0+3—
Oxygen consumed	1.9	B. coli (1/10 c.c.)	0+3—

These analyses show a water that is hard, slightly colored, and practically clear. The figures for nitrogen in its various forms are moderate as are also the figures for oxygen consumed and chlorine, denoting that organic matter is present in small amounts only. The total bacterial count is moderately high and organisms of the B. coli type were found in all of the 10 c.c. inoculations, denoting the presence of active contamination. This, from observations made in the field, is apparently of animal rather than human origin.

From the results of the analyses and from observations made in the field it may be concluded that the supply, though not subject to any permanent source of human pollution, is subject to contamination from nearby pasture and cultivated land, the road crossing the stream, and like all surface supplies is subject to accidental, incidental, and willful contamination by trespassers on the watershed.

It was therefore recommended that the authorities in charge maintain a strict supervision of the water supply at all times in order to detect and immediately remove any source of pollution which may arise.

HINSDALE

An inspection of the public water supply of the village of Hinsdale was made by Sanitary Inspector W. J. Erickson on September 29, 1920.

Hinsdale, which is an unincorporated village of 300 inhabitants, is located in the southeastern part of Cattaraugus county, about 6 miles north of Olean. Of the total population about 100 use the supply, which is owned by the Erie Railroad Company. There appears to be no one directly responsible for the maintenance and operation of the system. The consumers themselves clean the intake reservoir and basin whenever necessary. Most of the consumers have private wells from which their drinking water is obtained.

The supply is derived from a small spring-fed stream east of the village. This stream flows through the village and empties into Olean creek, the source of supply of Olean. The intake dam is located above the Erie railroad just east, and at an elevation of about 80 feet higher than the village. From this intake water is supplied to the consumers by gravity through about a mile of mains varying from 4 to ½ inch in diameter.

The supply is developed by the construction of a small masonry dam about 20 feet long, 4 feet high, and 20 inches thick. This dam forms a small reservoir which has been practically filled by gravel carried down by spring freshets. At the south side of the dam a small intake basin has been constructed against the side of the steep bank. The side toward the bank is of masonry construction and is of semicircular shape. The sides toward the stream are rectangular in shape. The basin is about 6 feet across and 4½ feet deep. There was about 2 feet of water in the basin at the time of the inspection. A wooden cover prevented foreign matter from entering the basin. A 20-inch opening in the lower side of the face parallel to the stream permits the water to enter. Leaves and other foreign matter are kept out by a quarter-inch mesh screen. This screen was very much rusted and was not effectual. The intake pipe extended into the basin and is provided with a strainer with ½-inch holes.

As is noted above, no one is directly responsible for the maintenance and operation of the water supply system. This is rather undesirable, as with no one in charge of the system it is liable to deteriorate and become a menace to the health of the community. For this reason, and on account of the rather unsatisfactory condition of the present supply, it would seem desirable that the village form a water district and develop a new and satisfactory source. In this way the village would obtain absolute control of the water supply and thus could operate it efficiently.

As a result of the inspection it was concluded that the water supply is subject to contamination from pasture lands along the stream, and at times of heavy runoff from possibly dangerous pollution from the farm houses and outbuilding located on the edge of the steep banks of the stream; that the supply is depreciated as to aesthetic quality due to the high turbidity at times of heavy surface runoff; and that the screen at the intake basin was in bad repair and should be replaced.

It was therefore recommended:

1. That the privy at the Rathburn farm be re-located at a safe distance from the bank of the stream and provided with a water-tight vault, the contents of which should be removed and buried at a distance of not less than 200 feet from the stream when necessary.
2. That the chicken yard at the Rathburn place be kept in a sanitary condition.
3. That the barnyard at the Flanagan farm be put in a sanitary condition, and manure pile removed at least 30 feet from gully.
4. That the stream around and for a distance of at least 300 feet above the intake be fenced so as to prevent trespassing on this area.
5. That the intake be provided with a new screen to prevent the entrance of leaves and debris.
6. That the village consider the proposition of forming a water ristrict and developing a new supply of satisfactory sanitary quality.

HOLLAND

A reinspection of the public water supply of the village of Holland, Erie county, was made by Mr. Henry Ryon, assistant engineer in this Department, on January 20, 1920, a previous investigation having been made by this Division in 1916.

The unincorporated village of Holland is located in the town of that name, in the southwestern part of Erie county, about 27 miles south of Buffalo. The estimated population of the village is 650. The water supply is furnished by the Holland Water Works Company. The company uses as a source of supply several springs on a hill about a mile south of the village and a well in the central part of the village and has recently drilled two wells at the south edge of the village with the intention of using the water from them to supplement the present supply. There is no record of the amount of water furnished but it is roughly estimated at 20,000 gallons per day. A storage reservoir of approximately 350,000 gallons capacity receives the surplus water from the springs. The water is not treated before it enters the distribution mains.

The conditions at the time of the recent investigation were practically the same as at the time of the previous one. The water from the springs was being used and supplemented by water from the well. The supply was apparently inadequate, for at the time of the inspection the pump was operating at the rate of about 25,000 gallons per day and it was impossible to raise the pressure at the pumping station above 20 pounds per square inch, a pressure too low to supply the higher parts of the village.

In order to obtain more water the company has drilled two additional 6-inch wells about 10 feet apart on the southern edge of the village. The wells are about 60 feet deep and extend through 30 feet of earth and 30 feet into shale rock. The well casings extend about 2 feet above the ground. It was stated that these wells were tested for quantity and yielded about 75 gallons a minute. The water level remains approximately 20 feet below the surface of the ground. The wells are located on the north edge of a low flat piece of land that is wet during part of the year, and it will apparently be necessary to protect the wells from the entrance of surface water by grouting around the casings and banking or by other suitable means. There are no buildings on the flat but on the land to the north or the village side of the wells which rises abruptly from the flat there are 4 or 5 houses within 500 feet of the wells. These houses are said to be sewered into the creek.

It was therefore recommended, in a report dated February 3, 1920 —

1. That as previously recommended the springs below the barn be abandoned as a source of water supply for the village, and that the privy located on the north side of the hill be removed to the south slope.
2. That all houses within 1,000 feet of any well (especially those above the level of the well) be provided with sewers, and that all sewer pipe within 200 feet of any well be of castiron laid with lead joints.
3. That before the water from the new well is turned into the mains the casing be grouted and embankments constructed effectively to prevent any surface water from approaching within ten feet of the wells.
4. That the water company consider the replacing of the wooden mains by castiron pipe.

HOLLEY

A reinspection of the public water supply of Holley was made by Mr. Earl Devendorf, assistant engineer in this Department, on September 28, 1920, a previous investigation of the supply having been made by this Department in 1917.

Holley is an incorporated village of some 1,700 inhabitants located in the eastern part of Orleans county, about 30 miles west of Rochester. The village is provided with a system of sanitary sewers and a sewage disposal plant consisting of Imhoff tanks and sprinkling filters, the effluent of which is discharged into Sandy creek. The water supply was formerly owned and operated by the Brockport-Holley Water Company but was acquired by the village in 1917, and is now operated under the direction of the board of trustees. The supply is derived from several springs or shallow wells located about 1½ miles south and southwest of the village, from which the water is pumped into the distribution system by two pumping plants. The consumption varies from 65,000 to 200,000 gallons per day, of which the manufacturing consumption amounts to 35,000 to 75,000 gallons per day.

At pumping station No. 1 there is a receiving well constructed with a steel casing and provided with a wooden cover. It is 15 feet in depth and 25 feet in diameter, and has a capacity of 50,000 gallons. There are four wells connected with the receiving well at the station, known as the Downs well, the North Salisbury well, the South Salisbury well, and the Clarendon well.

The Downs well is located about one-eighth of a mile south of the main pumping station in the middle of a field used as pasture. Although the village does not own the land surrounding the well, it does own the water rights and has a right of way for the pipe line. At the time of the inspection a horse and cow were found pastured in the vicinity of the well. The well is octagonal in form, 15 feet in depth and approximately 20 feet in diameter. It is constructed with a stone wall laid up with cement. The walls extend above the surface of the ground some 4 or 5 feet. The well is provided with a wooden cover. The bottom of the well is Medina sandstone which is said to contain large fissures. A door, which is kept locked, is provided for entering the well. The depth of water in the well was approximately 9 feet. No nearby permanent sources of pollution were observed at the time of the inspection. The nearest building was a barn located about 300 feet away from and below the well. The engineer at the pumping station stated that this well normally furnished from 25,000 to 30,000 gallons per 24 hours. No foot-valve is provided on the main leading to the receiving well at the pumping station and the water normally flows by gravity. At times of low flow, however, the engineer can pump from the wells to the receiving well and thereby augment the normal flow, as was being done at the time of the inspection.

The North and South Salisbury wells are located about one-eighth of a mile southwest of the main pumping station, and the village owns a strip of land some 600 or 700 feet in length and 200 feet in width surrounding these two wells which are located approximately 500 feet apart. The North Salisbury well is approximately 20 feet in diameter and 15 feet in depth, laid up with a stone masonry wall extending from the Medina sandstone rock to about 5 feet above the surface of the ground, and is provided with a wooden cover. In the bottom of the well a 6-inch hole, 70 feet in depth, has been drilled, and the 4-inch suction pipe extends into this hole 40 feet below the bottom of the well. A door, which is kept locked, is provided for entering the well. At the time of the inspection the depth of the water in the well was approximately 7 feet.

The South Salisbury well is 15 feet in depth and 20 feet in diameter, is laid up with a masonry wall extending 5 feet above the ground level, and is provided with a wooden cover. The door provided for entering the well is kept locked. The well extends to Medina sandstone rock into which a 6-inch drilled hole has been sunk. The 4-inch suction line extends only to the top of this drilled hole. The depth of water in the well was approximately 8 feet at the time of the inspection. No foot-valves are provided for the suction pipe at either the North or the South Salisbury well, and the water normally flows by gravity to the receiving well at pumping station No. 1. In times of low flow, however, the water may be drawn by means of the pumps at the pumping station into the receiving well, thereby augmenting the normal flow. No nearby sources of pollution were found at the North or South Salisbury wells. The land surrounding the wells, however, is used for pasture.

The Clarendon well, located about two miles southwest of the village near the highway, is approximately 16 feet in depth, and is constructed in the form of an angle, the two legs of which are approximately 60 feet and 114 feet in length, respectively, and 20 feet in width. The water at the time of the inspection was approximately 7 or 8 feet in depth. The well is provided with a wooden curb which has in several places rotted away, and there are now large holes giving opportunity for surface wash, animals, and foreign matter to enter. This well was not used last year, but due to the excessive demand and the shortage of water the well has been put in use during this past summer. In this connection it should be stated that the present excessive consumption should be reduced by the installation of meters and the discovery and elimination of any large leaks. While no nearby permanent sources of pollution were found at the time of the inspection, no fence is provided to prevent animals or trespassers from entering the land surrounding the well, which together with the poor condition of the curbing affords opportunity for contamination of either an accidental or willful nature.

The pipe line leading from the Salisbury and Clarendon wells to the receiving basin at pumping station No. 1 is laid in the bed of a small stream on which a dam has been constructed just above the pumping station, and the water impounded was formerly used for operating the pumps used to pump water for the village. At the time of the inspection the creek had been drawn down and a small leak had been discovered in the pipe line leading from the wells. At the time of the inspection the pipe line was under pressure in spite of the fact that the pumps were being used for drawing water from the wells. The leak, however, should be repaired and care taken to discover and repair any of the leaks that may occur in the future, since it is possible that hydrostatic conditions might occur which would create a negative head in the pipe line and thereby allow the contaminated creek water to enter.

Pumping station No. 2, which pumps water from the Glidden wells, has been reconstructed this year and consists of a one-story masonry building. There are two wells, the north and south Glidden wells, from which water is pumped from this station into the distribution system, the excess over consumption going to the standpipe. Normally the pumps are operated eight hours per day, but for the three days previous to the time of the inspection the pumps had been operated 24 hours per day. The north Glidden well is 24 feet in depth, constructed in gravel, and is built of wooden cribbing in the shape of an octagon approximately 25 feet in diameter. There was approximately 5 feet of water in the well at the time of the inspection. A 6-inch suction pipe from the well is connected to the pump and is provided with a foot-valve. About 300 feet south of the north Glidden well and attached to the pumping station building is the south Glidden well. This well has been provided during the past summer with a new concrete curb and sides extending down for about 15 feet, below which there is approximately 4 feet of timber cribbing. The well is approximately 25 feet in diameter, and is provided with a cover. The water was approximately 4 feet in depth at the time of the inspection. Normally, there is said to be 10 to 12 feet of water in these Glidden wells. The south well is at a higher elevation than the north well. The pump is operated with the valve on the south well suction open three turns and the valve on the north well suction wide open. This is said to maintain the water level in the two wells approximately at the same elevation. There were no sources of pollution near the Glidden wells. A small stream bed passing near the Glidden wells was dry, and the engineer was informed that previous to the wells being operated the stream flowed almost continuously, indicating that the ground water had been sufficiently lowered around these wells to cause the stream to disappear except during periods of heavy runoff.

It was therefore recommended, in a report dated November 26, 1920:

1. That the authorities in charge of the public water supply take immediate steps to cut down the daily consumption by the installation of meters and the stoppage of any large leaks in order that the present public supply may be sufficient for the public needs.
2. That fences and proper drainage ditches be constructed around the Salisbury and Downs wells in order to eliminate the opportunities for contamination, and that if after these precautions are taken contamination still exists, these sources of supply be sterilized by means of liquid chlorine, or a new source of supply be obtained.
3. That the authorities in charge of the public water supply have the leak in the main now located in the bed of the creek immediately stopped.
4. That the Clarendon well be either abandoned or properly protected from pollution by the construction of a new water-tight curbing, drainage ditches, and fencing.

HORSEHEADS

A reinspection of the public water supply of the village of Horseheads, Chemung county, was made by Mr. Earl Devendorf, assistant engineer in this Department, on April 28, 1920, a previous investigation of this supply having been made in 1916.

Horseheads is an incorporated village located in the western part of Chemung county, about six miles north of Elmira. Newton creek, which discharges into the Chemung river, flows through the village. The population at the time of the inspection was estimated to be about 2,000.

The water supply is owned by the village and operated by the village board of trustees. The water supply is obtained from springs located approximately one-half mile east of the village on the east side of Beaver brook.

The water is pumped from a collecting well by means of a motor operated Rumsey triplex pump into the village distribution system, the surplus going to a reservoir located on a hillside about 1½ miles east of the village. There are about 12 miles of water mains varying from 4 to 10 inches in diameter, and the average pressure in the village is approximately 95 pounds per square inch. There are 479 service taps, all of which are metered. The average daily consumption is estimated to be approximately 125,000 gallons per day. The capacity of the reservoir is approximately 275,000 gallons.

At the time of the recent inspection it was found that the conditions had been changed to some extent. An earthen embankment had been constructed along the easterly bank of Beaver brook in an endeavor to keep the water from the brook from flowing into or through the springs located above the collecting well. This embankment, however, was only from 1 to 2 feet above the surface of the brook at the time of the inspection, and the engineer was informed that during the spring freshet the brook overflowed this embankment, became mixed with the spring flow and thence flowed into the collecting well, causing the public water supply at that time to be quite turbid. The village authorities have also purchased and fenced in the land surrounding the springs located north of the pumping station. A house with barn and outbuildings is located on the property north of the springs. The barn is some 200 feet distant from and above the land surrounding the springs, and at the time of the inspection was not in use. The house was occupied at the time of the inspection, and the privy is located approximately 50 feet beyond the barn. A cultivated field lies east of the springs, and a corner of it is so located that the surface wash from it flows on to the land surrounding the springs. The village authorities are at the present time negotiating with the owner for the purchase of this property.

At the factory of the Nestle's Food Company it was found that there was a cross connection between the village water supply main and that of an auxiliary supply taken from an old canal and pumped to an elevated tank. This cross connection consisted of a plain 2-inch gate valve. It was stated that the city supply is seldom used, but it is considered necessary to augment the auxiliary supply at times of breakdown. This cross connection should be provided with double check valves in addition to double gate valves in accordance with the plans adopted and approved by this Department for such connections. In other respects the conditions surrounding the supply are the same as these described in our former report. The village authorities have not carried out our previous recommendation of securing a new source of supply, but have however secured the services of Mr. Charles C. Hopkins, consulting engineer of Rochester, to draw plans for enlargement of the present reservoir. The cost of this improvement is estimated at approximately $13,000, and at a special election held the day previous to the date of the inspection the village rejected the proposition of carrying out the improvement at this time.

In view of the above it was therefore recommended:

1. That as previously recommended a new source of supply be obtained which will be both adequate in quantity and of satisfactory sanitary quality, either by the construction of new wells to be located in more satisfactory surroundings or by obtaining water from the public supply of the city of Elmira.
2. That until such a new and satisfactory supply can be obtained, the present springs and collecting well be properly protected against contamination by the construction of adequate embankments to prevent the brook at times of high water from overflowing the land near the springs and collecting well, and the surface wash from the land near the springs from contaminating the public source of supply, and by the purchase of the triangular field located east of the springs.
3. That at the Nestle's Food Company factory the auxiliary supply used for manufacturing and boiler purposes be separated from the public water supply by the use of double check valves, in accordance with the plans approved by this Department, a plan of which is appended hereto.

HUDSON

A reinspection of the public water supply of the city of Hudson was made by Engineering Assistant W. J. Erickson on May 25, 1920, a previous investigation of the supply having been made in 1913.

Hudson, a city with a population of about 12,000, is located in the western part of Columbia county, on the east bank of the Hudson river. Practically all of the population of the city and about 200 people in outlying districts are served by this supply. The waterworks are owned by the city and are under the direction of the commission of public works.

The water supply is derived from Taghkanic creek, at a point about 12 miles southeast of the city, and from a small stream tributary to the Churchtown reservoir. From the intake dam of the creek water flows through a 16-inch and a 12-inch pipe to the Churchtown reservoir (85,000,000 gallons), thence by gravity to the filter plant located on a hill three-quarters of a mile southeast of the city. After passing through a slow sand filter the water is distributed to the consumers through 18 miles of castiron mains. In addition, there are about 16 miles of castiron pipe from the reservoirs to the city. The average consumption is about 2,000,000 gallons per day.

The original slow sand filter at Hudson was the second to be installed in the United States. This has been discontinued and is now being used as a clear water basin. The present sand filter is uncovered and has an area of .53 acre. The depth of sand is kept at about 6 feet under which is about a foot of graded gravel. The depth of water maintained over the filter is generally 3 or 4 feet. The average rate of filtration is about 3,780,000 gallons per acre per day and the maximum rate is 4,710,000 gallons per acre per day. There are no regulating devices for automatically controlling the rate of filtration. Filtered water is collected by a series of open joint bell and pigot drain tile. When it is necessary to clean the filters water from the clear water basin is first used after which unfiltered water is delivered to the consumers.

The main drain filter tile discharges the filtered water into a rectangular masonry effluent chamber which is divided by a concrete wall into two compartments. The filtered water has been chlorinated in the second compartment since 1914. At the time of the inspection about .3 parts per million of liquid chlorine were being applied to the water. From the effluent chamber the water is discharged into two covered clear water or distributing reservoirs having a total capacity of 3,448,000 gallons. These basins are below and adjacent to the filter bed.

As a result of the inspection it was concluded that the supply was of reasonably satisfactory sanitary quality, and that with continued efficient operation of the filter and chlorination apparatus the plant should yield a satisfactory water; that certain recommendations made by Mr. Hazen in regard to the operation of the filter plant have not been carried out; and that the lack of duplicate filter units makes it necessary periodically to interrupt the filtration while the bed is being cleaned and to deliver unfiltered water to the consumers.

It was therefore recommended:

1. That the Commission of Public Works carry out the recommendations of Mr. Hazen's report regarding the installation of regulating apparatus at the filter plant.
2. That the filter bed be subdivided in order to facilitate cleaning, or that another filter unit or units be added.
3. That all the water be effectively chlorinated before delivery to the consumers.
4. That the city continue making its frequent and regular inspections of all parts of the watershed in order to detect any violations of the water rules and to abate any such violation should it occur.

HUNTINGTON

A reinspection of the public water supply of the unincorporated village of Huntington, Suffolk county, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on June 21, 1920, a previous inspection of this supply having been made by this Division in 1915.

Huntington is located in the northwestern part of the town of Huntington, about 36 miles from New York city. The population in winter is estimated at 9,000, and increases in summer to 12,000. Of the total population, about 75 per cent are served with water from the public water supply. The waterworks are owned and operated by the Huntington Water Works Company.

The water supply is derived from 12 driven wells located in the southeastern part of the village. The water is pumped into tanks under air pressure for serving the lower part of the village, and into a concrete reservoir for serving the upper part of the village, from which the water flows by gravity to the distribution system, consisting of 27 miles of cast-iron pipe. The average daily water consumption in winter is approximately 175,000 gallons, and in summer increases to 225,000 gallons. Since the last inspection the only change which has been made in the plant is the abandonment of one 250,000-gallon Worthington pump.

The wells are 8 inches in diameter and 60 feet deep, driven through 20 feet of sand, 2 feet of hardpan, and 38 feet of water-bearing gravel.

The district in which the plant is located is only sparsely populated, there being six or eight houses within 500 feet of the plant. About 150 feet east of the plant several houses are provided with concrete cesspools which are cleaned periodically and inspected monthly. A 10-inch tile sewer, part of the village sewerage system, passes within 40 or 50 feet of the wells. A privy is located southwest of the pumping station that is provided with a metal container.

As a result of the reinspection of the public water supply of Huntington, it was concluded that the water supply of the village of Huntington cannot be considered as one of entirely satisfactory sanitary quality; that the supply is apparently receiving pollution from some source and that no provision has been made to sterilize the water; and that the houses in the vicinity of the water plant and wells have not all been connected to the sewerage system.

It is therefore recommended that the water company immediately install suitable apparatus for the sterilization of the water with liquid chlorine, and apply the chlorine to the water continuously and in proper proportions effectively sterilize it at all times; and that steps be immediately taken to determine and as far as possible eliminate the sources of pollution.

IROQUOIS (Thomas Indian School)

Plans for a pumphouse and pumping equipment for the waterworks of the Thomas Indian School, at Iroquois, Erie county, N. Y., consisting of state architect's drawing No. 2015, were submitted to this Department for approval on June 10, 1920. The plans were carefully examined by the Engineering Division, and in a report dated July 2, 1920, it was recommended that they be approved subject to the condition that before the pumping equipment be installed detailed plans of pump piping and connections and the method of protecting the well against surface wash should be submitted to this Department for approval. The plans were approved in accordance with these recommendations on June 10, 1920.

On July 24, 1920, plans for additions to the equipment of the water supply at the school, consisting of state architect's drawing No. 2016, were submitted to this Department for approval, and after careful consideration by the Engineering Division were approved on July 27, 1920.

JAMAICA WATER SUPPLY COMPANY

A reinspection of the public water supply furnished by the Jamaica Water Supply Company to the village of Floral Park, the unincorporated villages of New Hyde Park and Bellrose, and portions of the towns of Hempstead and North Hempstead in Nassau county, and also to Jamaica, Richmond Hill, Hollis, Springfield, Laurelton, and other places in Queens county, N. Y., was made by Mr. Alfred Mullikin, assistant engineer, on May 12 and 14, 1920. A previous inspection of this supply was made by the Engineering Division in 1916.

The waterworks are owned and operated by the Jamaica Water Supply Company. The total population served by the water supply is estimated at between 65,000 and 70,000.

The water supply is derived from three groups of driven wells, two of which are located in Jamaica and one in Elmont. From the wells the water is pumped through a distribution system consisting of 190 miles of castiron pipe ranging from 4 to 16 inches in diameter. Three steel standpipes take the surplus and act as equalizing reservoirs, maintaining a pressure in the municipalities of approximately 80 pounds per square inch.

There are two pumping stations at Jamaica, known as No. 1 and No. 2, which deliver approximately 1,250,000 gallons and 4,500,000 gallons daily, respectively. The Elmont pumping station delivers approximately 1,600,000 gallons daily. The total daily consumption, therefore, is approximately 7,350,000 gallons, or about 113 gallons per capita. In general, the details of the waterworks system remain as described in previous reports, with the exception that four shallow wells have been driven at one plant, and that a new pumping plant, located in Jamaica, will be put in operation within a month.

In a report dated December 6, 1920, the following conclusions were drawn:

1. That the authorities in charge of the water supply have carried out the previous recommendations of this Department.

2. That there are certain possibilities of serious contamination of the supply at the No. 1 pumping station, namely, the open well chambers which contain considerable rubbish and are subject to pollution; the possibility that dangerous contamination may reach the supply from the pumping station toilet which is located very close to the receiving well; and the unsatisfactory conditions of the blow-off pit located near the stream.

3. That the iron content of the water from No. 2 pumping station is high and may cause the water to be unsatisfactory in taste, color, odor, and by the formation of deposits.

It was therefore recommended:

> 1. That the authorities in charge of the water supply clean, repair, and properly cover the well chambers at No. 1 plant, provide a more sanitary toilet and toilet-room and maintain them in satisfactory condition, and connect the toilet to a line of castiron pipe having tight lead joints to conduct the sewage to a suitable cesspool located at a considerable distance from the supply or to a sewer.
>
> 2. That the blow-off or abandoned well pit be filled in with dirt and the blow-off pipe extended to the stream.

JEFFERSONVILLE

A reinspection of the sanitary condition of the public water supply of Jeffersonville was made by Mr. W. J. Erickson, engineering assistant, on June 15, 1920, a previous inspection of this supply having been made in 1915.

Jeffersonville, which is an unincorporated village of about 400 inhabitants, is located in the northwestern part of Sullivan county, about halfway between Callicoon and Liberty. The village has been formed into a water district under the direction of the board of water commissioners.

The water supply is derived from a storage reservoir on Lickel brook, about a mile and three-quarters north of the village. From this reservoir the water is conducted by gravity through an 8-inch pipe to the distribution system, consisting of three miles of mains varying from 4 to 8 inches in diameter. At times of fire the supply is supplemented by pumping direct from Callicoon creek. The water supply system is practically the same as described in the previous report.

At the time of the present inspection the Lickel reservoir was full and the water in it was very highly colored. The bottom of the reservoir was covered with brush and growths. The area tributary to the reservoir is approximately 4 square miles in extent and has a population of about 60 inhabitants, or 15 per square mile. There are about 12 dwellings on the watershed, most of which are located back from the stream and its tributaries. There are, however, some opportunities for contamination by the wash from cultivated fields and grazing lands along the stream as well as from the highways traversing them. Rains had fallen steadily for some time previous to the inspection.

Callicoon creek flows through relatively thickly populated land and consequently there are numerous possibilities for the contamination of this supply. It was stated that when the supply has to be used, adequate warning is given to the consumers to boil their drinking water. However, it has been found by experience that all the consumers will not boil their drinking water, even though adequate warning so to do has been given. It would therefore seem advisable that the auxiliary supply be sterilized, and in order fully to protect the consumers the regular supply should also be sterilized.

From these considerations the following conclusions were drawn in a report dated September 22, 1920:

1. That the water supply of Jeffersonville as derived from Lickel brook is subject to indirect contamination by surface wash from pasture lands and from highways traversing the watershed.
2. That the water is depreciated in aesthetic quality by the high color and turbidity caused by the brush, grass, and algae on the reservoir, and from the wash from the road passing near and above the reservoir.
3. That the Callicoon creek supply is subject to more serious contamination from dwellings and other permanent sources of pollution on the watershed as well as from chance visitors thereon.

It was therefore recommended:

1. That the board of water commissioners of Jeffersonville make regular and thorough inspection of the watershed of Lickel brook and Callicoon creek in order to detect any sources of contamination, and when such sources of contamination are found they be immediately removed.
2. That the Lickel brook be protected from surface wash by the construction of adequate drainage ditches to divert the road drainage to a point below the reservoir.
3. That the Lickel brook reservoir be cleaned of all grass and underbrush in order to obtain a supply as free as possible from decaying organic matter and algae.
4. That the commissioners apply to this Department for the enactment of rules and regulations for the protection of the public supply.
5. That should it be found necessary to use the supply from Callicoon creek, ample warning be given to the residents of the village to boil the water used for drinking purposes.
6. That on account of the many opportunities for contamination, particularly on the watershed of the Callicoon creek, and due to the fact that experience teaches that all drinking water will not be boiled even if warning so to do has been given, the board of water commissioners consider the advisability of installing some form of steriliziation apparatus to treat the supply, either by the application of liquid chlorine or by chloride of lime.

JOHNSON CITY

A reinspection of the public water supply of Johnson City was made by Mr. Earl Devendorf, assistant engineer, on September 25, 1919, a previous investigation having been made by this Division in 1916.

Johnson City is an incorporated village of about 9,000 inhabitants located in the southern part of Broome county, 3 miles west of Binghamton. The public water supply is owned and operated by the village under a board of water commissioners.

The water supply is obtained from 6 drilled wells 8 inches in diameter, and 2 dug wells 5 feet and 6 feet in diameter respectively, all of which extend to a depth of 60 feet. These wells are located in the northern part of the village near Chocomut creek. In addition, there are 2 dug wells 5 feet in diameter and 20 feet and 25 feet in depth, located at the Endicott-Johnson mill in the village. From the wells the water is pumped direct to the distribution system, the excess over the consumption going to a reservoir located on a hill about 1 mile north of the village. The average volume of water pumped from the municipal station amounts to approximately 1,300,000 gallons per day. In addition, approximately 1,750 gallons per minute were being pumped from the Endicott-Johnson mill, wells giving a total distribution of 2,500,000 gallons per 24 hours. A large percentage of this amount is used for industrial purposes.

At the time of the recent inspection it was found that none of the former recommendations of this Department had been carried out, and that at the time the village was experiencing an extreme shortage in its available water supply. Additional new wells were therefore being drilled on Camden street, near the Susquehanna river in the western part of the city. The engineer was informed by the city officials that a temporary connection was to be made with the public water mains from this source of supply.

For the immediate consideration of the officials, therefore, a preliminary report on the sanitary quality of these new wells was made and transmitted to the village officials under date of October 6, 1919, in which it was pointed out that the wells could be considered as a satisfactory addition to the present water supply if the quantity should prove sufficient; and furthermore, that if the land in the vicinity of the wells should remain vacant and no sources of pollution established at nearby points, it was probable that the quality would continue to be satisfactory.

Additional wells have been added to the public water supply since the time of the 1916 investigation. Two dug wells 20 feet and 25 feet in depth and 5 feet in diameter are located at the Endicott-Johnson mill, and are known as the old well and new well respectively. Each well is provided with a steel casing extending from the surface to the bottom of the wells. The new well has been in use since December, 1918, and while the normal rate of operation is 2,500 gallons per minute, only 1,500 gallons per minute were being pumped at the time of the inspection. Water from the old well is pumped by means of a 6-inch Fairbank-Morse centrifugal pump, operated normally at a rate of 1,000 gallons per minute, but at the time of the inspection the rate of pumping was only 250 gallons per minute. The city of Binghamton trunk sewer passes within 50 feet of the old well and 25 feet of the new well.

At the main pumping station a well 5 feet in diameter and 60 feet in depth was dug in 1916, and in 1917 another well 6 feet in diameter and 60 feet in depth was dug. These dug wells and the 6 drilled wells are connected to the suction lines direct. The 6-foot well has not been used at any time owing to a leak in the suction line from it. The sanitary surroundings of these wells are as described in the previous report and are not satisfactory.

In view of the above facts, the following conclusions were drawn in a report dated March 4, 1920:

1. That none of the previous recommendations of this Department have been carried out by the authorities in charge of the water supply of Johnson City.

2. That the village was experiencing an extreme shortage in its available water supply at the time of the investigation.
3. That the additional well supplies at the Endicott-Johnson mill which have been added to the public water supply are derived from ground water sources subject to pollution.
4. That as pointed out in our previous report the present public water supply is derived in part from ground water receiving pollution from various sources.
5. That the new well supply which has been developed in the western part of the village appeared to be of a satisfactory sanitary quality at the time of the inspection.

It was therefore recommended:

1. That the village authorities in charge of the water supply take steps to carry out the recommendations of the former report at as early a date as possible.
2. That in view of the many questions of prime importance in connection with both the sanitary quality and the quantity of the supply, it is further recommended that the village engage the services of a competent consulting expert to advise them in regard to the development of a new permanent source of supply of satisfactory sanitary and physical quality.

KEESEVILLE

A reinspection of the sanitary condition of the public water supply of Keeseville was made by Mr. W. J. Erickson, engineering assistant, on September 10, 1919, a previous inspection having been made in 1915.

Keeseville is an incorporated village of about 1,800 inhabitants, and is situated partly in Clinton and partly in Essex counties, about 5 miles inland from Lake Champlain. The village derives considerable water power from the Ausable river which flows through the village. There are no public sewers but numerous private sewers empty into the river, and there are also numerous cesspools and privies.

The public water supply, which is owned by the village and operated by the board of water commissioners, is derived in part from the Ausable river and in part from a deep well driven near the bank of the river. The intake is located just above the power dam of the village on the south bank of the river. The water is pumped directly into the distribution system. There is a reservoir on the top of the hill in the southern part of the village, but it was not in use as the pumping pressure is not sufficient. There are approximately 6 miles of mains varying from 10 to 2 inches in diameter, on which there are 180 service taps, 85 per cent of which are metered. The pressure is about 75 pounds at the pumping station, but some difficulty is experienced in obtaining sufficient pressure in the upper part of the village. There are about 1,000 consumers, or about 55 per cent of the population of the village.

A flume carries the river water to the water-wheels which operate the pumps and to the suction well. This flume takes the water from near the surface of the river near the south shore. Between the flume and the suction well is a galvanized iron screen with 1/4-inch mesh.

The well is 503 feet in depth. The first few feet is through the top soil, the rest of the distance being through rock of varying character. An 8-inch casing extends to a depth of 200 feet. The largest amount of water is said to be derived from between the depths of 200 and 300 feet; the yield, however, is rather small. At the time of the inspection the well was not being used.

The present inspection found the conditions the same as on the former inspection and that none of the recommendations had been carried out. The Ausable river is unsatisfactory as a source of water supply on account of the pollution which enters it. The watershed has an area of approximately 476 square miles, consisting mainly of steep slopes in the Adirondack mountains.

Except for several villages and hamlets the watershed is sparsely populated. There are in all about 9,000 residents on the watershed, or 19 per square mile. The principal centers of population are Clintonville, Ausable Forks, Black Brook, Jay, Upper Jay, Keene, Keene Valley, Wilmington, and Lake Placid. At some of these villages sewers are known to empty into the river, and the same is probably true at the majority of the hamlets. Lake Placid has a sewer and sewage disposal system the effluent of which eventually reaches the river. At Ausable Forks the pulp mills discharge sulphite wastes into the stream. In Keeseville itself there are sewers which discharge into the stream above the intake. Besides the numerous permanent sources, there are also many other opportunities for accidental or willful contamination by inhabitants and visitors on the watershed.

The well is very unsatisfactorily located in a thickly settled neighborhood. In addition to the general possibility of serious contamination, there is a leaky storm sewer also carrying the sewage of 3 or 4 houses, which passes within a few feet of the well. It seems possible that at times the well water receives contamination either from this sewer or from the numerous privies and cesspools above the well, by seepage through the fissures in the rock.

The unsatisfactory condition of the water supply is very well known to the inhabitants and it is stated that few if any use the supply for drinking purposes without boiling, potable water being obtained generally from private wells.

As a result of the inspection it was concluded that the recommendations of our previous report have not been carried out by the village authorities although the need for them still exists and that the water supply of Keeseville is derived from sources that are unsatisfactory from both the physical and sanitary standpoints.

It was therefore recommended in a report dated January 15, 1920, that the village authorities take immediate steps to carry out the previous recommendations of this Department.

KINGS PARK (State Hospital)

Plans for proposed extensions to the water supply system, consisting of state architect's drawing No. 2073, to serve the new building for acute patients at the Kings Park State Hospital, Kings Park, Suffolk county, N. Y., were submitted to this Department for approval by the State Architect on March 17, 1920. After careful consideration by the Engineering Division the plans were approved on March 19, 1920.

LAKE PLACID

A reinspection of the sanitary condition of the public water supply of Lake Placid, was made by Mr. W. J. Erickson, engineering assistant, on September 5, 1919, previous inspections of this supply having been made in 1911 and 1914.

Lake Placid is an incorporated village in Essex county, located on the shores of Mirror Lake, a small lake emptying into the West branch of the Ausable river and adjacent to the southern end of Lake Placid. The village is located in a region of great natural beauty and is a well known summer resort. It has a permanent population of about 1,800, while in the summer vacationists increase it to about 6,000.

The water supply derived from Lake Placid is owned by the village, and the present plant was put in operation in 1906. A chlorination plant for the treatment of the supply was installed in 1918. There are about 17 miles of mains, ranging from 1 to 12 inches in diameter, under an average pressure of 95 pounds per square inch. Besides serving all of the village itself, it serves the camps of the Whiteface Inn district, Buck Island,

and the Ruisseaumont district. The population served ranges from 1,800 in winter to 6,000 in summer.

Lake Placid has a water surface of 3.2 square miles and a total drainage of 20.7 square miles. There are about 75 summer cottages or camps on its shores. The Shore Owner's Association is cooperating with the local board of health in taking steps to prevent the pollution of the supply. Those camps which are not connected with the public sewer system are required to have watertight collecting cesspools from which the sewage is pumped to disposal plants some distance from lake or streams tributary to the lake. Practically all are finely appointed permanent camps and in satisfactory sanitary condition. Inspections are made regularly once a month to detect and abate any pollution which may arise. As the lake is used considerably for bathing, boating, and fishing, there are possibilities of pollution from these sources.

The chlorination plant was not in operation at the time of the inspection, and the superintendent informed the inspector that it had not been operating for some time, due to the objections of the consumers because of the taste. It was stated, however, that the plant would be put in operation shortly. When in operation chlorine is applied at the rate of about .18 p. p. m.

From the above facts the following conclusions were drawn: That the water supply of Lake Placid is comparatively free from possibility of contamination during the winter but is subject to contamination during the summer months, from the residents and visitors along the lake and its tributaries; that though the efforts of the village authorities tend to reduce the number of permanent sources of contamination, sanitary patrol alone cannot be relied upon to prevent all temporary sources or acts of contamination; that on account of the use of the lake for pleasure purposes there exists the possibility of direct contamination of the lake water at the intake which might bring about disastrous consequences were the chlorination apparatus not operating.

It was therefore recommended in a report dated January 12, 1920, that the authorities continue their vigorous policy in abating and controlling sources of contamination, and that the chlorine plant be operated carefully and continuously, especially during the summer months.

LIVINGSTON MANOR

A reinspection of the sanitary condition of the public water supply of Livingston Manor was made by Mr. W. J. Erickson, sanitary inspector in this Department, on October 28, 1920, a previous investigation of this supply having been made by this Division in 1919.

Livingston Manor is an unincorporated village with about 1,500 inhabitants, located in the northern part of Sullivan county, Practically all of the inhabitants use the public supply which is owned and operated by the Old Homestead Water Company.

The supply is derived from Hardenburg creek, a small stream which is fed by Matawa and Leneppe lakes. An intake dam has been constructed on this stream about 2 miles south of the village, forming a small distributing reservoir. From this reservoir the supply flows by gravity through a distribution system consisting of about 2 miles of 10-inch wooden mains, and about 6 miles of castiron pipe varying from 3 to 8 inches in diameter, on which there are 153 service taps only one of which is metered. The average pressure in the village is about 65 pounds per square inch. In general, the system is as described in the previous report.

As a result of the inspection it was concluded that the sanitary quality of the water supply of Livingston Manor is menaced during the summer months by the use of the lakes at the headwaters of the stream tributary to the reservoir for recreational purposes, and pollution from animals and chance visitors on the watershed; that the supply is depreciated as to physical quality by the high turbidity caused by rapid runoff at times of heavy rainfall, and by tastes and odors from algae growths during the warm summer months; and that the shallowness of the reservoir, with dead trees and other vegetation in it, render conditions favorable for the development of algae growths.

It was therefore recommended in a report dated December 8, 1920:

> That as a means of affording better protection of the water supply from contamination by residents or chance visitors on the watershed, the Old Homestead Water Company publish and enforce rules and regulations for the protection of the supply enacted by this Department in 1914; that as a means of further safeguarding the sanitary quality of the supply, the company install suitable apparatus for the sterilization of the supply by chlorination, and apply proper amounts of chlorine to the water at all times; that in order to improve the physical quality of the supply the depth of the reservoir be increased by increasing the height of the dam as planned, and by stripping the bed of the reservoir of dead timber, brush, and other decaying vegetable matter; that the growth of algae be prevented by the judicious use of copper sulphate; that the company consider the installation of a modern filtration plant.

The water of this supply is used by the New York, Ontario and Western Railway Company for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on December 14, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were not entirely satisfactory, and that the results of the inspection and the analyses of the samples, together with the results of previous inspections and analyses, indicate that the water cannot be considered to be of satisfactory sanitary quality for human consumption unless the recommendations made in our report are carried out. A copy of the report accompanied this data.

LOCKPORT

A reinspection of the public water supply of the city of Lockport was made by Mr. Earl Devendorf, assistant engineer in this Department, on March 19, 1920, previous investigations of the public water supply having been made by this Division in 1911, 1915, 1916, 1917, 1918, and 1919.

Lockport is a city of some 20,000 inhabitants located about 20 miles east of Niagara Falls, 25 miles northeast of Buffalo, and 12 miles south of Lake Ontario. The water supply of Lockport is obtained by pumping from the Niagara river, the intake being located about one-fourth of a mile below the intake of the city of North Tonawanda, and about one-fourth of a mile from shore. The water is conveyed from the intake by means of a pipe line to a large suction well, from which it is drawn and pumped after chlorination into the pipe line leading to the city some 14 miles away. The daily water consumption, as obtained from the records of the Venturi meter at the pumping station, varies from 6,000,000 to 7,500,000 gallons per day. This corresponds to a daily per capita consumption of from 325 gallons to 350 gallons.

Previous investigations have shown the unsatisfactory sanitary quality of the Niagara river water, and the reports upon the inspections subsequent to the installation of the chlorination plant have recommended careful and continuous operation of the chlorination apparatus and the application of adequate amounts of chlorine, the use of scales to check the accuracy of the control, regular bacteriological analyses, the installation of a duplicate chlorinator, the construction as soon as feasible of a modern filtration plant and storage facilities.

As a result of a recent inspection it was learned that since the last inspection a new Wallace & Tiernan chlorination apparatus of the dry-feed type has been installed. It was also learned that all of the recommendations named above have been carried out with the exception of the latter two, namely the installation of a modern filtration plant and storage facilities.

At the time of the recent inspection the engineer was informed by the operator at the pumping station that the river water had been very turbid on March 11, 12, and 13 of this year. From the health officer it was learned that the results of an analyses of a sample of water collected on the 13th of March showed the presence of gas in all of the presumptive tests, indicating a dangerously polluted condition of the supply. The public was accordingly informed on the evening of March 15 by means of handbills and announcements from the moving picture theatres, that the water was unsafe for use without boiling. In addition to these notices, an advertisement was inserted in the daily paper on March 16 advising the people to boil the water, and at the time of the inspection this advertisement was still running in the daily paper.

Following this investigation, a second investigation was made by this Division during the week of March 29 to determine the cause of the very turbid condition of the Niagara river during the period of March 11, 12 and 13. As a result of this second investigation, covering an examination of the weather bureau records of wind and weather conditions prior to and subsequent to this period, testimony of other waterworks officials operating plants along the Niagara river, and an examination of the records of operation of these plants, it was determined that this turbid condition of Niagara river was the result of excessive high water conditions of Buffalo creek which carried surface wash to the Niagara river. This condition was very unusual and lasted for a period of only two or three days.

At the time of the recent inspection a copy of the report on the bacteriological analysis of samples of water collected during this period was obtained from the superintendent of water of the city of Lockport. A table showing the results of these analyses is given below:

Date	Total Count 48 hr. Gelatine	B. coli 1 c.c.	B. coli 3 c.c.	B. coli 10 c.c.
March 10	26	0+3—	0+3—	0+3—
	27	0+3—	0+3—	0+3—
13	340	3+0—	3+0—	3+0—
	460	3+0—	3+0—	3+0—
14	330	0+3—	1+2—	3+0—
	345	0+3—	0+3—	2+1—
15	135	0+3—	0+3—	2+1—
	115	0+3—	0+3—	1+2—
	205	0+3—	2+1—	2+1—
	170	0+3—	0+3—	2+1—
	155	0+3—	0+3—	1+2—
16	117	0+3—	0+3—	2+1—
	128	0+3—	0+3—	1+2—
17	92	0+3—	0+3—	0+3—
	92	0+3—	0+3—	0+3—

The results of these analyses show that the public water supply of Lockport was seriously polluted for a period of some three or four days due to the very turbid condition of the Niagara river caused by the heavy runoff referred to above. In this report it should be pointed out that had a storage reservoir of a capacity equivalent to three or four days' consumption been available, the pumping of this very turbid water might have been stopped until the disappearance of the turbidity in the river. Another important circumstance which shows the urgent need for a storage reservoir is the fact that the city is supplied with water pumped through a single pipe line some 14 miles in length. Should any accident occur in this pipe line the city would be without fire protection as well as without water for domestic purposes in a very short time, since the standpipe has a capacity equivalent to approximately only one-half a day's consumption. If a storage reservoir having sufficient capacity for several days' consumption were provided, the city would be supplied with water for a sufficient period to permit of repairing any ordinary break in the pipe line.

As a result of the recent investigation it was concluded that all of the previous recommendations of this Department have been carried out with the exception of the construction of a modern filtration plant and the installation of a storage reservoir; that the recent unsatisfactory sanitary quality of the water supply was occasicned by the very turbid condition of the Niagara river which lasted for a period of 3 or 4 days about the middle of March; that the preventive measures undertaken immediately by the local health authorities in the form of advising the people to boil the water and the administration of typhoid vaccine probably prevented any serious outbreak of waterborne disease. It was therefore recommended in a report dated April 14, 1920, that a modern filtration plant be installed as soon as practicable, and a storage reservoir of sufficient capacity for several days' consumption to be constructed near the city at an early date in order that a sufficient supply of water of a satisfactory sanitary quality may at all times be furnished to the consumers of Lockport; that the city continue the present method of careful operation of the chlorination plant and the making of frequent analyses of the supply in order to check the efficiency of the sterilization of the supply.

LONG BEACH

A reinspection of the public water supply of Long Beach was made by Mr. Alfred Mullikin, assistant engineer, on January 7, 1920, a previous inspection having been made in 1915.

Long Beach is an incorporated village in the town of Hempstead, Nassau county, having a summer population of about 5,000. It is situated on an island parallel to the south shore of Long Island, about 25 miles from New York city. The waterworks are owned and operated by the Long Beach Water Company.

The water supply is obtained from a dug well 9 feet in diameter and 50 feet deep, known as well No. 1, located in East Rockaway, in the town of Hempstead, about 1,000 feet south of Lynbrook station of the Long Island railroad. The water company owns another well, known as well No. 2, located on the north side of the East Rockaway passenger station at Long Lane, a few feet from the Long Island railroad tracks. This well has been abandoned although when used it will yield 400 gallons per minute. At this well there is a 6-inch cross-connection with the Queens County Water Company which can be used for an emergency supply.

The water from the well is pumped to the Long Beach standpipe through 20,000 feet of 24-inch force main, which is of wood stave construction except at channel crossing where castiron pipe is used. At ebb tide the force main is exposed in numerous places. Due to repeated exposure to tidal conditions in a salt marsh, the steel bands have corroded, and the wood has disintegrated to such an extent that for several years only by continual repairs has the force main been kept in service. At times of low pressure it is possible that the head of marsh water over the pipe line is greater than that within the pipe and that leakage of polluted salt water may enter the main.

The results of these analyses show a water of good physical characteristics as regards color, appearance, and taste. The figures for nitrogen in its various forms, with the exception of those for nitrates, are not excessive. The rather high figures for nitrates indicate organic pollution of the ground water tributary to the supply, which however had undergone natural processes of purification. The increase in the chlorine content after the water had passed through the long pipe to Long Beach indicates the infiltration of salt marsh water. The total bacterial counts are usually moderate and from no samples have organisms of the B. coli type been isolated from any inoculations.

As a result of the investigation it was concluded that the public water supply of Long Beach was of a satisfactory aesthetic and sanitary quality at the time of the inspection; that the condition of the long force main from the Lynbrook pumping station to Long Beach is such that infiltration of salt marsh water may occur under certain conditions; that there is some possibility of contamination reaching well No. 1 through the 6-inch pipe extending from the strainer section to the surface; that pollution of the ground water tributary to the well may be brought about from the privy at the pumping station in case the privy is not maintained in a sanitary condition at all times; and that the abandoned well at the East Rockaway railroad station is open to possible contamination due to its inadequate protection from trespassers and to the manner in which water is drawn therefrom by residents in the vicinity.

It was therefore recommended, in a report dated January 28, 1920, that the waterworks authorities take action toward the replacing of the present woodstave force main; that a cap be placed over the 6-inch pipe at well No. 1, and a float and cord telltale be used to determine the well water level; that the privy and the vicinity at the pumping station be maintained in proper sanitary condition; that the well at East Rockaway be kept securely locked, and that regular analyses be made of the supply, and if contamination be found present steps be taken to eliminate its source if possible, or to sterilize the supply with liquid chlorine.

LONG EDDY

A reinspection of the public water supply of the unincorporated village of Long Eddy was made by Engineering Assistant W. J. Erickson on May 20, 1920, a previous inspection of this supply having been made by this Division in 1915.

Long Eddy, a village with a present population estimated at 250, is located in the western part of Sullivan county. Of the total population, about 100 are served by the public supply. The waterworks are owned and operated by the Long Eddy Water Company under the supervision of Mr. Armstrong, superintendent.

The supply is derived from Pea brook, a small stream tributary to the Delaware river. The intake is located about three-quarters of a mile north of the center of the village. The water is supplied by gravity through about a mile of water mains varying from 2 to 6 inches in diameter. There are about 30 taps in the village, none of which are metered. The average pressure in the village is 80 pounds per square inch. There is no accurate data as to the consumption.

A small timber dam has been constructed across the stream, and numerous 1-inch holes are drilled in a wooden bulkhead to admit the water into a small wooden box from which an 8-inch pipe leads to a small storage reservoir approximately 30 feet wide, 100 feet long, and about 4 to 5 feet deep, formed by a masonry dam located a few hundred feet below the intake. A wooden flume carries the water from the upper end of the reservoir to a point near the intake to the village main. This reservoir was practically empty at the time of the inspection, the water going directly into the mains. It had not been cleaned for some time and the bottom was covered with a fine mud and branches at the time of the inspection. Considerable trouble has been experienced from algae growths.

The watershed tributary to the intake is approximately 4 square miles. The valley is narrow, bounded by high, rocky hills. The upper part of the valley is less precipitous and wide. The runoff is very rapid due to the rocky and shaly formation of the valley. There are several abandoned quarries along the valley which were at one time extensively worked. There is at present considerable farming done in the valley.

The total population may be estimated at 80, or about 20 per square mile. There are about 15 houses, a church, a schoolhouse, a butter factory, and a sawmill on the road paralleling the stream. In addition to possible indirect contamination from these places, there are opportunities for contamination from highway wash and runoff from cultivated fields and pasture lands.

As a result of the inspection it was recommended: that the water company clean the reservoir in order to prevent as far as possible the growth of algae, and if necessary treat the water with copper sulphate applied in proper quantities; that the intake be protected by suitable screens or strainers; that the water company make a thorough inspection of the watershed from which the supply is derived, and eliminate all direct source of pollution found thereon; that should the water company experience any difficulty in removing all direct sources of pollution, it should apply to this Department for the enactment of rules and regulations for the sanitary protection of the supply.

MANHASSET

A reinspection of the public water supply furnished by the Manhasset and Lakeville Water District of the unincorporated villages of Manhasset, Great Neck Hills, a part of Great Neck, and Plandome, Nassau county, was made by Mr. Alfred Mullikin, assistant engineer, on June 11, 1920, a previous inspection of this supply having been made by this Department in 1915.

Manhasset is located in the northwest part of the town of North Hempstead, about 15 miles from New York city. The present population is estimated at 3,000, of which about 50 per cent or 60 per cent are served with water from the public water supply. The waterworks are owned and operated by the municipality under the direction of the Manhasset and Lakeville Water District, of which Mr. Owen P. Kennedy is chairman.

The water supply is derived from four driven wells located west of the village on the west bank of Manhasset Bay, about three-quarters of a mile southwest of the Manhasset depot. From the wells the water is pumped through the distribution system consisting of 27 miles of castiron pipe ranging from 4 to 12 inches in diameter the surplus going to a steel tank having a capacity of about 160,000 gallons. The pressure in the village ranges from 60 to 145 pounds per square inch. There are 605 service taps, of which 500 are metered. The average daily water consumption ranges from 151,000 gallons in winter to 600,000 gallons in summer. In general the details of the waterworks system remain as described in the previous report.

The four driven wells are located in a low swampy land about 1 acre in area near the Long Island railroad. The wells vary in depth from 133 to 157 feet. One well is 3 inches in diameter, another 4½ inches, and two are 8 inches in diameter. The strata through which the wells pass consist of 100 feet of sand, 5 feet of very fine sand and clay, and the remainder of the distance through a water-bearing gravel.

While there were no direct sources of pollution noticed at the time of the inspection, it is possible that pollution may enter the supply either by percolation through the soil from the existing privies and cesspools located among a number of houses 200 feet south of the well.

From the recent inspection it appears that the municipal authorities have carried out in part the previous recommendations as set forth in our report, in that a sewerage system has been constructed in the vicinity of the plant, that some of the buildings located near the wells have been connected to this sewerage system by castiron pipes, that the cesspool which receives sewage from the toilet at the pumping plant has been abandoned and this toilet connected to the sewerage system, that two privies some 50 feet from the well have been abandoned, and that analyses of the water are made yearly to detect active contamination of the supply.

As a result of this inspection it was concluded that the water supply was of a relatively satisfactory sanitary quality at the time of the inspection; that the authorities in charge of the water supply have in part carried out the previous recommendations of this Department, but that there remain certain opportunities for contamination of the supply from privies and cesspools near the well. It was therefore recommended that the municipal authorities carry out at once such of our previous recommendations as have not been acted upon and that the authorities maintain a careful sanitary patrol at all times in the vicinity of the wells to detect and eliminate any possible sources of pollution.

MARCY (Utica State Hospital)

Plans for a filter plant and a pumping station for the Marcy division of the Utica State Hospital were submitted to this Department for approval by the State Engineer on April 26, 1920. The plans proposed for the construction of a waterworks consisting of coagulation basins, gravity mechanical filters, a clear water basin, a chlorinating plant, and centrifugal pumping equipment. After careful consideration by the Engineering Division the plans were approved on April 28, 1920.

Plans for a distribution system for the water supply of Marcy division of the Utica State Hospital, consisting of state architect's drawings Nos. 2089 and 2096, were submitted to this Department for approval on July 10, 1920, and after careful consideration by the Engineering Division were approved on August 9, 1920.

MASSENA

A reinspection of the public water supply of the village of Massena was made by Mr. Alfred Mullikin, assistant engineer, on January 27, 1920, a previous investigation of this supply having been made in 1911, 1915, 1916, and 1917.

Massena is a village located in the northern part of St. Lawrence county, about 160 miles north of Utica. It occupies both banks of the Grasse river. The water supply is owned by the St. Lawrence Water Company and is pumped from the Massena power canal. Part of the supply is pumped to the plant of the Aluminum Company of America and part to the village. All the water is treated with liquid chlorine and that delivered to the village is filtered through two pressure mechanical filters, The population is about 10,000. The amount of water pumped to the plant of the Aluminum Company is 2.700,000 gallons daily, and to the village is 2,250,000 gallons daily. There are no domestic water meters and only 12 commercial meters.

At the time of the inspections only one of two suction mains was in use, due to the fact that one of the two chlorine solution chambers was undergoing repairs. The solution chambers are placed about 10 feet above the suction main on a separate platform to overcome back pressure. The chlorine feed for 4.75 million gallons amounts to 13.5 pounds, or .35 parts per million.

The recent inspection disclosed the fact that although the Water company has apparently been operating the chlorination plant with care and efficiency, the capacity of the filtration plant has not been increased to meet the increased rate of water consumption nor have proper coagulation and sedimentation facilities been provided. The rate of filtration when the filters are in operation is approximately 400 million gallons per acre per day, a rate nearly four times the proper rate for this type of filter.

As result of this investigation it was concluded that steps have not been taken by the Water Company to install a sedimentation basin nor to increase the filter area as previously recommended by this Department; that liquid chlorine is being carefully applied to the water but that chemical or bacteriological tests are not made in order to obtain comparable records of the raw and filtered water. It was therefore recommended that sedimentation be provided, and that additional filters be installed as previously recommended by this Department; that if it is planned to apply chlorine to two different suction lines, a second control apparatus be installed, and that a competent consulting engineer be obtained to advise them as to the best method of placing the water purification plant in proper condition.

MECHANICVILLE

An investigation of an outbreak of typhoid fever in the city of Mechanicville was made on April 12 and 13, 1920, by Mr. Earl Devendorf, assistant engineer. On September 28, 1920, a reinspection of the water supply of this city was made by Mr. Henry Ryon, assistant engineer. Previous investigations of the supply were made by this Department in 1917, 1918 and 1919.

Mechanicville is a city of 8,900 inhabitants, located in the southeast part of Saratoga county, on the west bank of the Hudson river. Practically all of the inhabitants of the city are served by the public water supply, which is delivered to the consumers through about 22 miles of mains, varying from 4 inches to 6 inches in diameter, on which there are some 1,100 service taps, all of which are metered. The total water consumption is estimated at about 1,500,000 gallons per day, of which the railroad and the factories in the city use more than half. The pressure in the village varies from 60 to 85 pounds per square inch. Part of the supply is filtered and an attempt is made to chlorinate all of it.

The supply is derived from two streams known as Plum brook and Baker brook, and collected by two impounding reservoirs—one located on plum brook about 1½ miles northwest of Willow Glen, a small hamlet about 2 miles west of Mechanicville; and the other on Plum brook just below its junction with Baker brook, about ¼ of a mile northwest of Willow Glen. The capacity of the upper reservoir is estimated as 90 million gallons and the watershed tributary to it has an area of approximately 2.0 square miles. The lower reservoir has a capacity of about one million gallons and an area tributary to it of approximately 2.2 square miles, exclusive of that of the upper reservoir, making the total watershed 4.2 square miles. The population on the shed is estimated at about 200 persons, or about 50 persons per square mile. In 1919 all the houses on the watershed were visited by representatives of the Engineering Division of this Department, and it was found that in 10 out of 20 houses there were histories of typhoid fever.

The upper reservoir is connected directly to the city distribution system, the elevation being sufficient to furnish a satisfactory pressure without pumping. The lower reservoir is too low to give a satisfactory pressure by gravity and a pumping plant has been constructed immediately below the reservoir, arranged to force the water into the pipe leading from the upper reservoir to the city, which passes a few feet to the east of the station. The water from the lower reservoir is all filtered before being discharged into the main, and when the plant is operating properly is treated with liquid chlorine in sufficient quantity to sterilize it and also the water which flows to the city by gravity from the upper reservoir.

The water passes first through the roughing filter and then through the sand filters from which it is discharged into a clear water basin. No coagulant is used. The character and method of operation of the filters is such that it seems improbable that effective purification is secured.

The pumping equipment consists of 2 Worthington tandem compound duplex pumps, one 10x16x10x12, and the other 14x20x14x12. The latter was in use at the time of the inspection and was operating at 32 r. p. h., which with a reasonable allowance for slip would indicate that it was discharging water into the main at the rate of about 1,300,000 gallons per day. Since the average water consumption of the city is in the neighborhood of 1,500,000 gallons per day, and the maximum rate of consumption probably considerably higher than the average, it is at once evident that at certain times a considerable proportion of unpurified water from the upper reservoir must reach the consumers. A single 75 h.p. boiler is provided for supplying steam for the pumps. It is understood that this boiler is cleaned once a month and the filters by-passed while the boiler is being cleaned.

The chlorinating apparatus is located in the pump room of the station and consists of a Wallace & Tiernan manual control solution-feed type B apparatus. At the time of the inspection the chlorination apparatus was not being used because the city had no chlorine, and as far as could be learned had had none since about September 13, 1920. It was therefore impossible to observe the rate of application of chlorine or learn anything regarding the effectiveness of the chlorine treatment. Reports on the bacteriological examination of the water by Mr. George E. Willcomb, consulting engineer for the city, indicate that some trouble has been experienced in securing an effective sterilization of the water even when a fairly large amount of chlorine is applied, due to some extent, as pointed out by Mr. Willcomb, to the organic content of the water but also probably to the method of application of the chlorine. It would seem advisable that until the plant has been reconstructed or a new supply developed, some means be provided for taking samples from the main just below its junction with the discharge pipe from the pumping station, so that samples of the water may be readily taken at frequent intervals; and that such samples be taken and tested for excess chlorine and the rate of application of the chlorine regulated accordingly.

At the time of the inspection there were six cases of typhoid fever in the city, and the records of this Department show that outbreaks of this character have occurred at frequent intervals during the past few years. In November and December of 1915, there were six cases of typhoid in the city. In June and July of 1916 there were 51 cases, followed by 6 more in the following few months. In 1917 there were 36 cases, the largest number occurring in August and December. In the early part of 1918, 31 cases occurred in the city.

In March and April, 1920, an outbreak of 15 cases of typhoid occurred. This outbreak was investigated by the Engineering Division of the Department, and as a result of this investigation it was concluded that the outbreak was the result of an infection of the public water supply, due to the fact that the city authorities had failed to carry out the improvements and recommendations of the Engineering Division with regard to the installation of the chlorination plant and the making of certain improvements at the pumping station, which had they been properly carried out would have without doubt prevented the outbreak of typhoid. It was accordingly recommended that the city authorities take immediate steps toward the installation of a chlorinating apparatus; that as soon as installed this apparatus be operated with the greatest possible care; that a new source of supply be obtained or a new filtration plant be constructed, or the present filtration plant reconstructed without delay; that if it was decided to reconstruct the present filter plant, provision be made for coagulating the water, and a coagulation basin be constructed and the pipe of the filters be arranged so that the first filtrate after washing may be wasted; and that the sanitary conditions on the watershed be improved.

Apparently no steps have been taken to improve the conditions on the watershed, and the filter plant has not been improved, nor as far as could be learned have any steps been taken toward the improvement of the plant or the construction of a new one. The recommendation regarding the installation of the chlorine apparatus has however been carried out, but, as pointed out above, the apparatus was not in operation at the time of the inspection of September 28, 1920.

From such information as could be obtained it appears that no chlorine was applied to the water from September 14 to October 2; and that during that period the polluted water from the brooks was allowed to pass into the mains with no other treatment than the partial filtration which the results of the analyses of the samples taken at the time of the inspection show was not effective in removing the contamination. This interruption in the application of chlorine was due to the city authorities allowing the supply of chlorine to become exhausted. In this connection it should be mentioned that the city authorities were on June 28, 1920, notified by the Engineering Division of this Department of the fact that owing to transportation conditions trouble was being experienced by many municipalities in securing shipments of chlorine, and were requested to furnish this Department certain information regarding their chlorine supply so that the Department might assist them if necessary, in case of danger of shortage. No reply to this letter was received. On June 30 another letter was sent to them by the Engineering Division, advising them how shipments of waterworks chemicals could be expedited through the Interstate Commerce Commission, and they were advised to keep a considerable quantity of chlorine on hand in order to avoid any possibility of a shortage. Apparently these warnings and suggestions were disregarded, for the supply was allowed to become exhausted and no effort made to secure a prompt shipment of the chemical in accordance with the advice of June 30, 1920, even after the supply had become exhausted.

In view of the above facts it was concluded:

1. That the water supply of Mechanicville is not in satisfactory sanitary condition.
2. That frequent outbreaks of typhoid fever have occurred in the city due to the unsatisfactory condition of the water supply.
3. That these outbreaks might have been and future outbreaks may be prevented by carrying out all of the recommendations of this Department, and exercising careful supervision over the watershed and the operation of the treatment plant.

It was therefore recommended:

That unless a new satisfactory course of supply is developed, the treatment plant be reconstructed or a new plant constructed, and

a A coagulant be added to the water in proper proportions at all times;

b A coagulation basin of suitable size, fitted with the necessary appurtenances, be provided and used;

c The piping of the filters be arranged so that the first water after washing may be wasted;

d A duplicate boiler be provided as that it will not be necessary to shut down the plant in order to clean the boiler;

e The piping near the station be rearranged so that raw water of the upper reservoir cannot be allowed to flow into the distribution system of the city;

f Liquid chlorine be applied to the filtered water continuously and in proper proportions.

That pending the completion of such improvements:

a All the water furnished to the city be sterilized at all times by the continuous application of a sufficient amount of liquid chlorine;

b A tap be made on the main a short distance below the junction of the main to the discharge pipe of the pumping station;

c Samples of water be taken from this tap at frequent intervals and tested for excess chlorine in accordance with the method approved by this Department;

d The rate of application of the chlorine be regulated in accordance with the results of these tests;

e A careful record be kept of the weight of chlorine used each day.

That the watershed from which the supply is derived be carefully inspected at frequent intervals and the rules and regulations for the protection of the supply from contamination enacted by this Department strictly enforced.

MEDINA

A reinspection of the public water supply of Medina was made by Mr. Earl Devendorf, assistant engineer in this Department, on October 16, 1920, a previous investigation of this supply having been made in 1916.

Medina is an incorporated village of some 6,500 inhabitants located in the western part of Orleans county. The village is served by a municipal sewer system which discharges without purification into Oak Orchard creek, a small stream flowing through the village and discharging into Lake Ontario.

The water supply is owned by the village and operated under a board of trustees. The supply is obtained from a dug well located about 3 miles south of the village, from which it is pumped to a concrete reservoir from which it flows by gravity into the village mains and a standpipe located in the village. Approximately 95 per cent of the population is served with the supply, and the consumption is estimated at about 1½ million gallons per day, or 230 gallons per capita per day. There are numerous cold storage and canning factories which, together with The New York Central Railroad Company, use during the season approximately 400,000 gallons, or 60 gallons per capita per day. This gives a domestic consumption of 170 gallons per capita per day, which is a very high rate.

The recent inspection was made as the result of information reaching this office that due to the shortage of water it had been necessary for the village to use canal water. At the time of the inspection it was ascertained that the standpipe located in the village had been painted during the summer and that before the painting had been completed the canneries and cold storage plants started operation, using large quantities of water, and it had been impossible to pump enough water from the supply to fill the standpipe. This reduced the amount of storage usually kept ahead, and occurring just at a time when the large consumers were drawing heavily reduced the storage held in the reservoir until it was necessary to augment the well water supply by the use of the fire pump at the S. A. Cook Furniture Company factory, which was used to pump water consisting of a mixture of canal water and Oak Orchard creek water. Pumping was begun at 11 A. M. on September 28 and continued until 1 A. M., October 1, 1920. The public had been previously warned by handbills distributed from house to house and by advertisements in the public newspapers, in which they were advised to boil the water. The fire pump is said to be connected by a plain gate valve to the village distribution system, which arrangement constitutes a potential source of contamination of the public supply. The pump is an 18 x 10 x 12-inch steam pump manufactured by the George F. Blake Manufacturing Company, and is said to have a rated capacity of 1,000 gallons per minute at 70 r.p.m.

At the time of the inspection it was stated that the village authorities in charge of the public water supply are contemplating augmenting the present water supply by the construction of an additional well or wells. Before any final plans are adopted, however, it seems advisable that the village engage a competent water supply expert to make a thorough investigation of the available sources of public water supply in the vicinity and advise them as to the most economical and proper means of developing the best source of supply in order that a public water supply may be furnished to the residents of the village which shall be at all times adequate in quantity and of a proper sanitary quality.

As a result of the inspection it was concluded in a report dated November 23, 1920, that as previously pointed out the public water supply of Medina is derived from a source which is free from any serious pollution, although it is subject to the possibility of pollution reaching the supply through the limestone formation in which the well is located; that due to excessive demand during the past summer by the canneries and cold storage plants located in the village, the public water supply was depleted and it was necessary to pump untreated water from Oak Orchard creek and the Barge canal overflow; that the fire supply system at the S. A. Cook Furniture Company, derived from Oak Orchard creek and the Barge canal overflow, is connected at present with the village distribution mains by a plain gate valve and may constitute a potential source of danger to the health of the residents of the village.

It was therefore recommended that the village authorities engage the services of a competent water supply expert to aid them in augmenting the present water supply; that in case it becomes necessary to again pump water from Oak Orchard creek and the Barge canal overflow before the supply is augmented by water from satisfactory additional sources, the water be first chlorinated in such a manner as effectively to sterilize the supply before it is pumped into the public mains, employing an engineer, if necessary, to advise them as to the means for carrying out this recommendation; that the present cross-connection between the fire pump at the furniture factory of the S. A. Cook Company and the village distribution mains be disconnected, or that a double check and gate valve be installed in an accessible manhole, in accordance with the general plans approved by this Department, a blueprint of which is attached to the report.

MERRICK

A reinspection of the public water supply of the unincorporated village of Merrick, Nassau county, Long Island, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on May 20, 1920, a previous inspection of this supply having been made by this Division in 1915.

Merrick is located in the southern part of the town of Hempstead, about 27 miles from New York city. The present population is estimated at about 1,500. Of the total population, approximately 50 per cent are served with water from the public water supply. The waterworks are owned and operated by the Hempstead and Oyster Bay Water Company.

The water supply is derived from four driven wells and one tile well located in the center of the development about one-fourth of a mile south of the Long Island Railroad station. From the wells the water is delivered by pumping through a distributing system consisting of about 6 miles of castiron pipe ranging from 2 to 6 inches in diameter. An elevated wooden tank having a capacity of about 15,000 gallons takes the surplus and acts as an equalizing reservoir, maintaining for domestic use an average pressure in the municipality of approximately 20 pounds per square inch. For fire protection, however, approximately 80 pounds per square inch is available from a pressure tank. This steel pressure tank has a total capacity of about 12,000 gallons. Of the 125 service taps, only relatively few are metered. The average daily water consumption in winter is approximately 20,000 gallons, and in summer approximately 35,000 gallons, or 27 and 47 gallons per capita respectively. In general, the details of the waterworks system remain as described in the previous report, with the exception that a windmill which supplemented the other pumping machinery has been abandoned. This windmill was ordinarily used to pump the water required for domestic use during the winter period.

The wells consist of two 3-inch driven wells, two 4-inch driven wells 45 feet deep, one 12-inch tile well about 35 feet deep, and one new 18-inch tile well 36 feet deep constructed in 1919. Surrounding the top of the 12-inch tile cased well is a manhole of brick about 3 feet in diameter and 5 feet deep. The water level rises in the well within about 6 feet from the surface of the ground. This well is not in use at present. The new 18-inch tile well is surrounded by a brick manhole about 3½ feet square and 5 feet deep which is provided with an unlocked wooden cover. The water level in this well recedes to a depth of 10 feet 4 inches from the surface of the ground while the pumps are in operation.

The land on which the plant is located is leased by the company and only a small tract is provided. Although the territory in the immediate vicinity of the well is now sparsely settled, it is probable that houses may be erected very close to the wells at some time in the future.

From the recent inspection it appears that the nearby buildings are provided with cesspools, which, however, in some cases may not be impervious; that no analyses are made throughout the year; and that there is apparently little opportunity for pollution of the ground water in the immediate vicinity of the wells.

As a result of the reinspection of the public water supply of Merrick it was concluded, in a report dated July 15, 1920, that the authorities in charge of the water supply have in part carried out the previous recommendations of this Department.

It was therefore recommended that precautions should be taken to see that all buildings erected in close proximity of the wells are provided with impervious cesspools, or privies with watertight containers, the contents of which should be regularly removed and properly disposed of in a remote place; that the pump pit be made impervious to prevent the entrance of surface water which is now generally allowed to seep into the ground at the west end in close proximity to the source of water supply; and that an impervious sump hole be constructed and a hand pump be installed in order that any water collecting on the floor may be delivered to some point remote from the wells.

MEXICO

A reinspection of the public water supply of Mexico was made by Mr. Earl Devendorf, assistant engineer, on August 6, 1919, a previous investigation of this supply having been made by this Division in 1916.

Mexico is an incorporated village of 1,300 inhabitants located in Oswego county, on the Niagara Falls, Oswego and Richland branch of the New York Central railroad, about half way between Oswego and Richland; and is also located on the Salmon river and Black creek.

The public water supply is owned by the municipality, and is operated by a board of water commissioners of which Mr. A. W. Richardson is superintendent. The supply is derived from the east branch of Black creek, about 2 miles south of the village. From the creek the supply is pumped after treatment with alum and hypochlorite of lime through pressure filters into the distribution system, and thence to a steel standpipe located in the village having a capacity of 140,000 gallons. The consumption varies from 40,000 to 60,000 gallons per 24 hours, corresponding to a per capita rate of 63 gallons and 92 gallons respectively.

The watershed of Black creek above the point from which the supply is derived is about one square mile in area and is principally used for agricultural purposes. There are some 40 or 50 inhabitants residing on the watershed. Nearly one-half of the area consists of swamp and wood land. The farm houses are located well back from the stream and afford very little opportunity for direct pollution of the water.

The recent inspection disclosed that the conditions of the public water supply remained practically the same as at the time of the former investigation and that the recommendations of our former report had apparently not been carried out. Except for the installation of a new auxiliary gasoline engine and an increase in the number of water consumers, the waterworks system remains as described in the former report.

At the filter plant the solutions are mixed in the chemical tanks, and it is customary to mix 20 pounds of alum and 1 pound of hypo per batch. The batches usually last for about 3 days' pumping, it being planned to mix a new batch after one day's pumping and to allow it to settle until the next day when it is ready for use. On the day of the visit, however, the operator had pumped for about one hour without treatment by alum or hypo due to having run out of the chemical solutions and having just mixed a new batch. In this connection it should be pointed out that no water should be pumped into the distribution system without being treated with alum and hypo in sufficient quantities effectively to remove color and to sterilize the supply.

As a result of the investigation it was concluded in a report dated March 4, 1920, that the former recommendations of this Department, as summarized above, have not been carried out, although the need for them still exists; and that for a short period of time previous to the recent inspection no chemical solutions were being used in connection with the operation of the pressure filters and the plant was not effectually purifying the supply.

It was therefore recommended that the village officials carry out the former recommendations of this Department as soon as possible; that great care be taken to operate the purification plant so as effectually to reduce the organic content and to provide sterilization of the public water supply at all times.

MIDDLEPORT

A reinspection of the public water supply of Middleport was made by Mr. Earl Devendorf, assistant engineer in this department, on October 17, 1920, previous investigations of this supply having been made in 1915 and 1919.

Middleport is an incorporated village located in the eastern part of Niagara county, about 11 miles south of Lake Ontario and about 45 miles west of Rochester. The present population is estimated at 1,600, of which about 75 per cent are served with the public water supply. The water supply is owned by the village and operated under a board of trustees. The public water supply is derived from a shallow well located about 3 miles southwest of the village. The consumption is estimated as between 80 and 150 thousand gallons per day, depending upon the season of the year. The water is pumped into the village distribution system, the excess over consumption going to a steel standpipe 14 feet in diameter and 65 feet in height, having a capacity of 75,000 gallons.

The recent investigation was made as the result of word having reached this office that canal water was again being furnished the consumers in the village due to a shortage of water. At the time of the inspection it was found that water was first pumped beginning September 10, 1920, and has been pumped every other day since. The auxiliary supply is obtained from the overflow of the Barge canal, and is pumped by means of a 16 x 9 x 12-inch Buffalo duplex steam pump having a rated capacity of 750 g.p.m. at 70 r.p.m., into the village distribution system, the excess over consumption going to a standpipe. The pump is located in the basement of the Lin-Del Fruit Company and is maintained as a fire pump. At the time of the inspection the pump had not been used for two days on account of broken valves. New valves had been ordered but had not yet arrived.

While no definite record of operation was kept, it was ascertained from the engineer at the plant that approximately 40,000 gallons of water had been pumped per day, and that the average amount of chlorine used was 2 pounds per day, or approximately 6 p.p.m. The chlorine is applied directly from the cylinder into the suction pipe of the pump, there being no manometer or other means of measuring or indicting the flow of gas other than the tank valve. This is not an entirely satisfactory manner of applying the liquid chlorine as there is no means of varying or controlling the rate of application of the gas with any degree of accuracy. The pump is normally separated from the city mains by a single check and gate valve, and the check valve had been removed in order to make it possible to pump water into the city mains. It was not known how long it would be necessary to continue pumping from the canal into the village mains, but it is expected that as soon as the first rainstorm occurred and relieved the present drought that the municipal supply would be sufficient to care for the needs of the village. The amount of water being pumped from the municipal supply was stated as being approximately 68,000 gallons, indicating that the present consumption is now about 100,000 gallons per day. There are six factories and one school which are the largest consumers. The amount of water used for industrial purposes was not known.

It is proposed to obtain an additional supply of water for the village from Middleport creek. At a point on the stream about 1½ miles south of the center of the village a 20 million gallon storage reservoir is to be constructed. Water from this reservoir is to be purified by means of a slow sand filter plant of approximately 200,000 gallons per day capacity, and forced by pumps through about 5,000 feet of 6-inch castiron pipe to the village distribution system. The pumping is to be maintained against the pressure given by the existing standpipe, the top of which is 104 feet above the proposed pumps. This proposed additional source of supply was approved by the Conservation Commission on March 25, 1920, subject to the condition that the village secure the enactment of rules and regulations for the sanitary protection of the watershed and rigidly enforce the same, and also that the supply be adequately filtered and sterilized.

At the time of the inspection the engineer was informed that the main core wall of the dam for the new reservoir has been completed, but that the village is awaiting a reduction in the market price of castiron pipe before letting the contract for the erection of the pumping station and new pipe line. It is expected that the new supply will be completed and ready for operation by July 1, 1921.

As a result of the inspection it was concluded in a report dated December 29, 1920, that in accordance with the previous recommendations of this Department, the village authorities have taken steps to secure a new public water supply of satisfactory sanitary quality and this supply is now in process of completion; that due to a shortage of the present water supply during the past summer, water from the Barge canal overflow has been pumped after chlorination into the village distribution mains; that the manner of chlorination of the auxiliary supply derived from the overflow of the Barge canal is not entirely satisfactory, in that no apparatus is provided for determining or controlling the rate of application of chlorine.

In view of the above it was therefore recommended that the new public water supply now under construction be completed at as early a date as possible; that when the new supply is completed the purification plant be placed under the supervision of a competent operator and be constantly and carefully operated in order that a public water supply of satisfactory sanitary quality may at all times be furnished; that no water from the Barge canal overflow be pumped into the public distribution system without effective sterilization of the supply, and to this end a chlorination apparatus be installed and effectively operated whenever it becomes necessary to use the Barge canal overflow.

MIDDLETOWN

A reinspection of the public water supply of the city of Middletown was made by Mr. W. J. Erickson, sanitary inspector in this department, on October 27, 1920, a previous inspection of this supply having been made in 1913. Rules and regulations for the sanitary protection of the supply were enacted in 1903.

Middletown is a city of about 18,000 inhabitants located in the west central part of Orange county. It is about 67 miles northwest of New York city, on the Erie railroad. The Middletown State Homeopathic Hospital is located in the northwestern part of the city.

The supply is owned and controlled by the city under the direction of the department of public works, of which Mr. John A. Korschen is commissioner.

The supply is derived from three storage reservoirs, the nearest being about a mile west of the city. The upper reservoir, known as Shawangunk lake, is connected with the lower or Monhagen lake, and forms the source of the Monhagen or low pressure supply. The central reservoir or Highland lake forms the source of the Highland or high pressure supply. The hill section of the city uses the Highland supply, the remainder being supplied from the Monhagen system. The supply is conducted from these reservoirs to the filter plant. From the clear water basin and the pressure filters the water flows by gravity through about 45 miles of castiron mains varying from 24 inches to 4 inches in diameter. There are about 2,600 service mains of which few are metered. The pressure in the mains varies from 35 to 80 pounds per square inch. The average daily consumption from the low pressure system is 2,750,000 gallons, and from the high pressure system 650,000 gallons, or a total of 3,400,000 gallons. When the planned additions and alterations to the filter plant are completed, the increased available supply will make it possible to increase the distribution system without overtaxing the filters.

The low pressure supply is derived from two storage reservoirs or artificial lakes. The upper one, Shawangunk Lake, has a surface area of about 400 acres and a depth of 24 feet, with an estimated capacity of 418,000,000 gallons. This lake, as well as the other two, appears to be largely spring-fed. One small stream, known as the Little Shawangunk kill, is impounded about a mile west of Shawangunk lake and is piped to the lake. Shawangunk lake also receives the overflow from the middle or Highland lake. From Shawangunk lake the water is conducted to the lower reservoir, Monhagen lake, through 3 miles of 30-inch pipe. The supply either flows into Monhagen lake over an aerating fountain, or may be by-passed directly to the gravity mechanical filters of the low pressure system.

Monhagen lake has a surface area of about 433 acres, with a capacity estimated at about 271,800,000 gallons. It is about 40 feet below the level of Shawangunk lake and about 20 feet above that of the filters. A 16-inch pipe conducts the water to the filters located in a brick building just across the road below the earthen dam which holds the lake water back.

Highland lake, which supplies the high pressure system, is located about two miles from the filter plant. The lake has a surface area of about 341 acres and a capacity estimated to be 517,000,000 gallons. It lies at an elevation of about 80 feet above that of the filters, to which the water is conducted by a 12-inch pipe. A second line has been laid from the lake alongside of the 12-inch line for a distance of 6,000 feet and then shunted with the old line.

The area tributary to the reservoirs is practically all owned by the city, and except for the homes of the caretakers which are so far removed from the lakes as not to endanger the supply, there are no permanent sources of pollution. The watershed of the Little Shawangunk kill is also in a satisfactory sanitary condition. The rules and regulations enacted by this Department are rigidly enforced. Two caretakers patrol the watersheds almost daily. Considerable trouble is experienced from algae growths in the reservoirs which continually clog the filters in summer, making frequent washing necessary. The judicious application of copper sulphate, starting in spring or early summer and continuing throughout the warm season, would tend to retard these growths and thus relieve the filtration plant to a large extent.

The filters are located in a brick building 38 x 130 feet in plan with a small wing 50 x 16 feet. The gravity filters are located in one side of the main building. At present there are eight units. The four original 14-foot cylinder cypress tank filters installed in 1900 are to be removed, and six additional Continental-Jewel filters, similar to those installed in 1908, placed in operation. These tanks are 11 x 16 feet inside and have 12-inch walls. The strainer system consists of 33 parallel rows of laterals from a 6-inch header. Those laterals are each tapped for ten ⅜-inch Continental-Jewel strainers. Over the strainers there is 9 inches of graded gravel in three layers and about 27 inches of sand. The filters are operated under a head of 28 inches. A fairly constant level is maintained by a valve over the influent line which is operated by a float. The inner walls are lower than the bounding walls, and when one filter overflows it overflows into the others. The filters are cleaned when they begin to overflow. This is done by reversing the flow. After the influent pipe has been closed and the head drawn to the gutters, air is blown through the bed for five minutes, then wash water for five minutes, then air again for five minutes and finally wash water until the bed is clean. The first filtrate is wasted. Ordinarily all filters are not operated at one time except when there is a vigorous growth of algae in the reservoirs, at which times all units must be placed in service because of the rapid clogging. The capacity of these units is half a million gallons per day for each unit. The total area of the present plant is about .0334 acres. The rate of filtration is therefore about 85,000,000 gallons per acre per day.

The coagulant tank is placed high over the filters so as to raise the orifice higher than the level of Monhagen lake. A small platform supported by two rafters carried two cylindrical cypress tanks provided with valves with glass ball floats. These tanks discharge into a rectangular tank also provided with glass ball floats. The discharge orifice is fitted with interchangeable calibrated ring weirs. Sulphate of alumina is used for the coagulant, and is dissolved in a small cylindrical tank and raised by water pressure to the storage tanks. About .8 of a grain is applied per gallon filtered, the exact amount depending upon the character of the raw water. The apparatus had become cloged just previous to the time of the inspection and no alum was being applied.

A clear water basin, 74 feet long, 36 feet wide, and 6 feet deep, having a capacity of 100,000 gallons, is located below the filter house. An additional clear water basin with a capacity of 250,000 gallons was being constructed just south of the filter plant.

Four horizontal steel tank pressure mechanical filters 8 feet high by 10 feet long are provided for treating the water of the high pressure supply. These filters are operated under a head of 80 feet, the difference between the filters and that of the level of Highland lake, the source of the raw water supply. The strainer system is similar to that in the gravity filters. Above the strainer system is a 6-inch layer of gravel and 24 to 30 inches of sand. The filters are washed when the loss of head in the tank reaches 10 pounds, using a method similar to that in washing the gravity filters. Usually they are washed once in 24 hours. To meet the needs of an increasing consumption, two additional units, similar to those already in use, will be installed. The capacity of these units is about 250,000 gallons per 24 hours. The total area of the present pressure filters is about .0073 acre based on the length and diameter of the cylinder. The present rate of filtration is therefore about 89,000,000 gallons per acre per day.

The coagulant for the pressure filters is applied by the Shunt current method through a castiron drum, the rate being regulated by the valves of the Shunt circuit. An average of about .8 grain of alum is applied per gallon of water treated.

When the additions to the filter plants are completed the area of the gravity filters will be increased to about .04 acre, and the yield increased to 5,000,000 gallons per day assuming 125,000,000 gallons per acre per day. The area of the pressure filter plant will be increased to about .011 acre. Making the above assumptions, the available yield may be estimated at 1,375,000 gallons per day. The total available yield for the plant would then be 6,375,000 gallons per day.

Chemical and bacterial analyses of both the raw and filtered water are made monthly by the city chemist in order to determine the efficiency of the operation of the plant.

From the results of this inspection it was concluded in a report dated November 26, 1920, that the supply was as free from sources of contamination as is possible for a surface supply, and is subject only to possible pollution by animals or visitors on the watershed; that the City of Middletown has taken commendable action in acquiring the watersheds by purchase and freeing them from permanent sources of contamination; that the rules and regulations are being strictly enforced; that in general the filtration plants are operated efficiently though at the time of the inspection, due to the temporary clogging of the alum feed pipe, no alum was being applied to the raw Monhagen water before filtration. It was therefore recommended that the department of public works continue to maintain the watersheds in a sanitary condition at all times, and that the filtration plant be continuously operated in an efficient manner.

The water of this supply is used by the Erie, the New York, Ontario and Western, and the Middletown and Unionville Railroads. Data regarding the supply were furnished to the United States Public Health Service on November 29, 1920, and included, in addition to the results of the analyses of samples of the water, the statement that at the time of the inspection the conditions surrounding the supply were satisfactory, and that the results of the inspection and the analyses of the samples, together with the results of previous inspections and analyses, indicate that the water was of satisfactory quality for human consumption. A copy of the report accompanied this data.

MIDDLEVILLE

A reinspection of the public water supply of the village of Middleville was made on October 21, 1920, by Mr. A. I. Howd, assistant engineer in this Department, previous investigations of this supply having been made by the Engineering Division in 1910, 1916, and 1918. Rules and regulations for the sanitary protection of the reservoirs and tributaries thereto of the water supply of the village were enacted by the Department in 1902.

Middleville has a population of about 710, and is located in Herkimer county, about 9 miles north of Herkimer. Of the total population, about 90 per cent are served with water from the public water supply. The waterworks are owned and operated by the municipality, under the direction of a board of water commissioners of which Mr. H. E. Jackson is president.

The water supply is derived from Kenyon brook, the intake being located about 2 miles northeast of the village. The water flows from the intake reservoir to a large storage reservoir having a capacity of about 21,000,000 gallons, from which it is delivered by gravity through a distributing system consisting of about 2½ miles of mains ranging from 4 to 6 inches in diameter. The pressure in the village is approximately 160 pounds per square inch. There are about 120 service taps, one of which is metered. There is no accurate method of estimating the water consumption of the village. In general, the details of the waterworks system remain as described in the previous report. In accordance with previous recommendations of this Department, the intake reservoir has been cleaned and the mains in the village are flushed several times a year. As far as could be learned, no action had been taken on other recommendations.

The watershed above the point of intake has an area of about ½ square mile, on which is located two farms. A highway runs practically the entire length of the watershed, and another highway crosses the stream about a mile above the intake. The water supply is subject to accidental and willful pollution from inhabitants, visitors, and animals upon the watershed.

At the factory of E. C. Mills Leather Co., Inc., there are two cross connections between the public water supply of the village and the fire protection and industrial system of the plant. A 6-inch connection from the village mains passes around the north side of the factory for the yard fire protection system. There is a single check valve on this connection near the street main. A 6-inch lateral is run from the connection into the factory, and there is a single check valve on this lateral in the basement of the factory. On a 3-inch riser from the lateral there is a gate above which the water is pumped into the riser from the West Canada creek, the water being used principally to operate elevators. The other connection between the public water supply and the industrial supply of the factory is through a tap on the south side of the factory. A single check valve and gate are located on the connection near Bridge street. Inside the factory, before the connection is made with the industrial supply, there is a gate, a meter, and a single check valve in succession. While this arrangement is fairly satisfactory, it cannot be considered absolutely safe. The connection between the public water supply mains and the industrial supply mains should be provided with gates, double check valves, gauges, and test valves, and should be readily accessible for inspecting and testing. The gates, valves, and other appurtenances should be installed in a suitably constructed manhole located at a convenient and readily accessible point outside of any building and near the municipal main.

As a result of the reinspection of the public water supply of Middleville, it was concluded that the authorities in charge of the water supply have in part carried out the recommendations of the previous report of this department; that the public water supply is subject to accidental and willful pollution from inhabitants, trespassers, and animals upon the watershed; that the public water supply is subject to possible contamination from the cross connections with a polluted industrial supply at the E. C. Mills Leather Co., Inc., and that the arrangement of the gates and check valves on this cross connection is not in accordance with the general plan approved by this Department.

It was therefore recommended that the diverting ditch around the reservoir be cleaned, as previously recommended by this Department; that the village authorities make regular, frequent, and effective inspections of the watershed and strictly enforce the rules and regulations enacted by this Department for the sanitary protection of the supply; that the village authorities consider the installation and operation of an apparatus for the sterilization of the supply with liquid chlorine; that the connection between the public water supply mains and the industrial supply mains be provided with gates, double check valves, gauges, and test valves in accordance with the general plan approved by this Department.

MILLERTON

A reinspection of the public water supply of Millerton was made by Mr. W. J. Erickson, engineering assistant of this Department, on May 29, 1920, a previous inspection having been made in 1917.

Millerton, which is a village of about 900 inhabitants, is located in the northeastern part of Dutchess county, about 60 miles southeast of Albany. About 90 per cent of the inhabitants use the public water supply which is owned and controlled by the village under the direction of a board of water commissioners. The water supply is derived from a spring near the head of a small brook about a mile west of the village, from the brook itself, and from a well located in the northwestern part of the village. The water from the spring and brook is collected in a small impounding reservoir from which it flows through a distribution system consisting of about 3 miles of mains ranging from 4 to 8 inches in diameter. There are about 300 service taps, of which only 13 are metered. The water consumption is estimated at 105,000 gallons per day in winter and 125,000 gallons per day in summer. The pressure in the village averages about 95 pounds per square inch. The well supply is pumped directly into the distribution system.

The spring is developed by the construction of a concrete basin in the bed of the brook from which the water is conducted by castiron pipe to the impounding reservoir 1,000 feet below. A concrete trough carries the stream over the spring and this prevents the water of the stream from entering the spring. The brook water runs to a small concrete intake basin provided with a ½-inch mesh screen from which a 3-inch pipe diverts part of the brook water into the impounding reservoir. The reservoir is formed by a small dam across the natural bed of the brook and has a capacity of about 300,000 gallons.

The watershed is about 50 acres in area. The area in the immediate vicinity of the spring and reservoir is owned by the village and is fenced. The area above the spring is used for pasturage.

The well supply is derived from about 10 drilled wells 20 feet deep. The strata consists of 18 feet of gravel and 18 inches of clay below which lies a water bearing gravel. The general conditions around the well were satisfactory at the time of the inspection.

As a result of this inspection it was concluded that the brook supply is subject to some pollution from pasture land on the watershed; that the spring is apparently adequately protected, and that the area in the vicinity of the well is in a sanitary condition.

It was therefore recommended that the village purchase or obtain the control of additional lands in the vicinity of the brook above the spring in order to prevent pollution of the water by cattle on the watershed, and that the area in the vicinity of the well be kept in a sanitary condition at all times.

The water of this supply is used by the Central New England Railroad for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on October 18, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were fairly satisfactory, and that the results of the inspection and the analyses of the samples, together with the results of previous inspections and analyses, indicate that the water was of doubtful sanitary quality for human consumption, and that certain improvements should be made. A copy of the report accompanied this data. Based on this information the United States Public Health Service, on November 11, 1920, issued a provisional certificate permitting the temporary use of the water for drinking and culinary purposes in interstate traffic.

MINEOLA

A reinspection of the public water supply of the village of Mineola was made by Mr. Alfred Mullikin, assistant engineer in this Department, on June 9, 1920, a previous inspection of this supply having been made in 1915.

Mineola is located in the southern part of the town of North Hempstead, about 21 miles from New York city. The population is estimated at 3,000. Of the total population, 90 per cent are served with water from the public water supply. The waterworks are owned and operated by the municipality under the direction of the board of trustees. The water supply is derived from two driven wells located in the eastern part of the village. From the wells the water is pumped through a distribution system consisting of 8 miles of castiron pipe ranging from 4 to 8 inches in diameter. An elevated steel water tank, 22 feet in diameter and 28 feet high, has a capacity of about 100,000 gallons and acts as an equalizing reservoir, maintaining a pressure of from 65 to 70 pounds per square inch in the municipality. There are 745 service taps, or which 600 are metered. The average daily water consumption is approximately 266,600 gallons, or 76 gallons per capita. This amount includes the water which is furnished to a population of about 800 in the village of East Williston. In general, the details of the waterworks system remain as described in a previous report.

The two driven wells are 12 inches in diameter and 80 feet and 91 feet deep respectively. The strata through which the wells pass are sand and gravel. The area occupied by the wells and pumping station are surrounded by houses but the most thickly settled section is west of the plant. The houses on this side of the wells are about 150 feet away and are generally provided with privies. The sewage from the toilet of the pumping station enters a brick cesspool located 50 feet south of the plant. The Oyster Bay branch of the Long Island railroad runs within 50 feet of the wells.

From the recent inspection it appears that the authorities have not carried out all of the recommendations set forth in our previous report, such as providing impervious cesspools and watertight containers for all privies within 500 feet of the wells; that regular analyses of the water have not been made; and that a complete sewerage system has not been installed to take care of the sewage from properties in the vicinity of the wells. A solution feed manual control Wallace & Tiernan chlorination apparatus has been installed but has been out of operation for two months.

As a result of the reinspection of the public water supply of Mineola it was concluded that the authorities in charge of the water supply have only in part carried out the recommendations of our previous report; that the water supply was of a relatively satisfactory sanitary quality at the time of inspection; that the chlorination apparatus was out of order, and that there remained several opportunities for serious contamination of the water at times of heavy draft on the wells.

It was therefore recommended that the chlorination apparatus be put in operation and chlorine applied to the water continuously at a rate of not less than .2 parts per million; that a duplicate chlorination apparatus be installed; that frequent tests of the chlorinated water for excess chlorine be made; that the village authorities carry out at once such of our previous recommendations as have not been acted upon; and that after the construction of a sewerage system all privies and cesspools be properly cleaned and abandoned.

MONTICELLO

A reinspection of the public water supply of the village of Monticello was made by Engineering Assistant W. J. Erickson on May 13, 1290, a previous inspection of this supply having been made in 1918.

Monticello, an incorporated village with a population of about 2,200, is located in the central part of Sullivan county. Practically all of the population is served by the supply. The waterworks are owned by the village and operated under the direction of the board of water commissioners.

The water supply is derived from Kiamesha lake, about 1½ miles north of the village. From the lake it is pumped directly into the distribution system, consisting of 14 miles of mains varying from 3 to 8 inches in diameter, the excess over consumption being stored in an open standpipe which maintains a pressure of about 60 pounds per square inch in the village. There are about 575 taps of which about 100 are metered. The consumption varies from 223,000 gallons per day in the winter to 400,000 gallons per day in the summer. The average consumption is about 300,000 gallons per day. At the time of the inspection the water system was practically the same as at the time of the previous inspection. A new suction well was being constructed at the pump station and one of the pumps was being overhauled. The walls at the station were badly cracked, and it was stated that they are to be repaired. The equipment of the pumping station is the same as described in the previous report.

Kiamesha lake has a watershed area of about ¾ of a square mile and a surface area of 140 acres. Due to the heavy influx of summer visitors to the hotels and boarding houses along the lake, the population on the watershed during the summer season reaches about 2,500 per square mile. Most of the larger hotels and boarding houses are provided with fairly satisfactory means of sewage disposal, but at times the lake receives gross pollution (especially along the northern shore) from surface drainage and overflowing cesspools. The unsatisfactory sewage collecting basin mentioned in the previous report has been replaced by a substantial concrete one. From this basin the sewage is continually being pumped to a point on the other side of the hill not on the watershed of the lake. At the time of the inspection the majority of the hotels and boarding houses had not yet been opened for the summer season, and the pollution of the lake from these sources could not be observed. In addition to the sewage pollution, the water of the lake undoubtedly receives considerable pollution from the surface drainage of the thickly populated district and from the boating and bathing in the lake.

In our previous report it was recommended that the village give consideration to a modern filtration plant supplemented by chlorination; that pending the installation of a filtration plant an apparatus for the chlorination of the supply be immediately installed and put in operation, and that a competent engineer be retained to study the whole problem. From the present inspection it appears that none of these recommendations have been carried out.

From these considerations it was concluded that the recommendations of our previous report have not been carried out; and that, though conditions have slightly improved, the supply is still subject to dangerous pollution from the population on the watershed, largely campers and summer boarders, and from pleasure seekers on the lake itself, and cannot be considered of a safe sanitary quality.

It was therefore recommended that the village authorities immediately install an apparatus for the treatment of the water supply by liquid chlorine, and apply chlorine continuously and at all times in such amounts as effectively to sterilize the water; that the village authorities take steps to have the rules and regulations enacted by this department for the protection of the supply strictly enforced; that the village authorities consider the installation of a modern water treatment plant, or the development of a new source of supply; that a competent engineer be employed to study the whole problem as to the most practical and economical method of obtaining a water supply of adequate amount and at all times of a safe sanitary quality, either by improving the present supply or by the development of a new source.

The water of this supply is used by the New York, Ontario and Western Railroad for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health

Service on October 18, 1910, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were found to be unsatisfactory, and that the result of the inspection and analyses of the samples, together with the results of previous inspections and analyses, indicate that the water cannot be considered of satisfactory quality for human consumption until the water is properly treated as recommended. A copy of the report accompanied this data. Based on this information the United States Public Health Service on November 11, 1920, issued a certificate stating that the use of the water for drinking and culinary purposes in interstate traffic was not permitted.

MORRISVILLE

A reinspection of the public water supply of the incorporated village of Morrisville, Madison county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on June 18, 1920, previous inspections of this supply have been made by this Division in 1917 and 1918.

Morrisville, a village with a present population estimated at 600, is located in the valley of Callihan brook, about 2½ miles west of the Morrisville station on the New York, Ontario and Western railroad, which station is 16 miles south of the city of Oneida. Of the total population, practically all are served with the public water supply. The waterworks are owned and operated by the municipality under the direction of the village board of trustees.

The water supply is derived from a reservoir located about ¾ of a mile from the village. From the reservoir the water is delivered by gravity to the distribution system, consisting of about 2½ miles of castiron pipe ranging in size from 4 to 10 inches in diameter. The average pressure in the municipality is approximately 86 pounds per square inch. Of the 150 service taps, all are metered with the exception of a few public taps and water motor connections. The average daily water consumption is approximately 24,000 gallons per day, or 40 gallons per capita per day. Storage is provided by the above mentioned reservoir. The general details of the waterworks system remain as described in the previous reports.

The watershed tributary to the supply contains about 60 acres and consists of uninhabited agricultural area. Opportunities for indirect pollution of the water supply by surface wash from the highway passing about 100 feet to the north of the reservoir were found. In our previous reports it has been recommended that the village authorities continue very careful supervision of the sanitary conditions of the reservoir and watershed, and that copper sulphate be applied to overcome the growth of algae which appears at times in the water. At the time of the recent inspection it was not learned that the application of copper sulphate has been attempted.

It was therefore recommended in a report dated September 10, 1920, that the municipal authorities in charge of the water supply carry out at once such of our previous recommendations as have not as yet been acted upon; that the village authorities exercise continual care to maintain the ditches intended to divert the surface wash of the highway in an effective condition.

MOUNT VERNON

An investigation of the sanitary condition of the water supply of the city of Mount Vernon was made by Mr. Henry Ryon, assistant engineer, on April 9, 1920. The investigation was made subsequent to an outbreak of typhoid fever in that city.

The water supply of the city of Mount Vernon is furnished by the New York Interurban Water Company of Mount Vernon, which also furnishes water to the village of Mamaroneck, town of Harrison, and to districts of

Orienta and Rye Neck. The supply of the company is obtained from three separate sources: The Mamaroneck river, the Hutchinson river, and Tom Paine brook.

The Mamaroneck river above the company's reservoir has a watershed containing about 12.8 square miles. This area has a population estimated at about 2,000, located principally in the northern portion of the watershed which lies in the village of White Plains. Although there appears to be no direct pollution of the river from permanent sources, the stream receives the runoff from this populated district which undoubtedly contains considerable polluting matter and is of course subject to accidental pollution. All the water from this source is treated at the Mamaroneck plant before being discharged into the mains.

The Hutchinson river watershed above the company's reservoir and intake of Pelham has an area of 2 square miles and has a population of about 400. The stream receives the street wash and surface drainage from this district, undoubtedly containing much polluting matter. One of the Mount Vernon sewers carrying considerable sewage passes close to the stream and apparently had recently overflowed allowing considerable volume of sewage to pass directly into the river. The water of the Hutchinson river is collected in the reservoir at North Pelham and treated at the North Pelham plant before being discharged into the mains.

The Tom Paine brook has a watershed of about 1.9 square miles and a population estimated at about 150. This area receives less pollution than the watersheds of either of the other sources, but the water is not satisfactory for use as a public water supply without proper treatment. The water is collected in a Mahlsted reservoir and siphoned to the Pelham plant where it is treated with the Hutchinson river water before being pumped into the mains. Rules and regulations for the protection of the water supply of Mount Vernon were enacted by this Department in 1907.

At the Mamaroneck plant the water is treated by coagulation, chlorination and filtration through rapid pressure filters. The water flows from a small reservoir one mile north of the village of Mamaroneck to a 500,000 gallons coagulation basin, alum being applied to the water as it enters the basin. The water then flows to the pump well where liquid chlorine is applied at a rate of from .2 to .4 parts per million. From the pump well the water is discharged into the mains through 4 pressure mechanical filters operated in parallel. The average rate of filtration based on the average flow of 2,235,000 gallons per day was about 130,000,000 gallons per acre per day. The filtered water is discharged into a 16-inch main leading to Mamaroneck, Harrison, and Mount Vernon.

At the Pelham plant the Hutchinson river and Mahlsted reservoir water is treated by slow sand filtration and chlorination. With the average flow of about 1,400,000 gallons per day, the rate of filtration is about 1,200,000 gallons per acre per day. Chlorine is applied to the filtered water as it passes through the suction to the pumps by a Wallace & Tiernan solution feed apparatus, chlorine being applied at the rate of about .34 parts per million. The pumps discharge into the 16-inch main from the Mamaroneck supply.

The distribution system of the company consists of about 80 miles of cast-iron pipe varying from 4 to 16 inches in diameter. A standpipe located in the southeastern part of Mount Vernon takes the surplus water.

From the above facts it was concluded that the raw water from the streams used by the New York Interurban Water Company is not suitable at any time for human consumption without proper treatment; that no tests are made to determine the exact quantity of alum and chlorine needed for the varying quality of the raw water; that owing to laxity of supervision of the Mamaroneck plant at Mamaroneck, polluting matter passed through the plant and reached the mains, and that cases of typhoid fever which occurred in Mount Vernon, Mamaroneck, and Harrison, were apparently due to pollution from the Mamaroneck watershed passing through the treatment plant and reaching the consumers. It was therefore recommended that the water company continue the careful supervision of the watersheds and reduce the sources of contamination to a minimum; that they make daily tests of the raw and filtered water to determine the exact quantity of alum and chlorine needed; that the chlorine cylinder connections be so arranged that two cylinders may be kept connected to the apparatus at all times; and that the company exercise more careful supervision over the operation of the filtration and chlorination plants.

NEW BERLIN

A reinspection of the public water supply of the village of New Berlin, Chenango county, N. Y., was made by Mr. N. H. Baier, sanitary inspector in this Department, on November 23, 1920, previous inspections of the supply having been made by this Division in 1913 and 1919.

New Berlin is located on the Chenango river, in the northeastern part of the town of New Berlin. The present population is 1,140, of which practically all are served by the public water supply. The waterworks are owned by the village and are under the control of the board of trustees, of which Mr. E. D. Talbot is president, and Mr. H. Hill is superintendent.

The water is derived from Howard brook and springs, located 1½ miles east of the village. The water from the brook is impounded in a large, open reservoir, from which it flows by gravity through a 14-inch main to a socalled spring reservoir located about 400 feet west of the large reservoir. The water from the springs enters at one end of the spring reservoirs through open masonry work. There is a chlorinating plant about one-half mile west of the large reservoir, from which the water passes by gravity through a distributing system consisting of some 4 miles of castiron pipe ranging from 4 to 10 inches in diameter. The pressure varies from 37 to 120 pounds per square inch, with an average of 110 pounds per square inch. Of the 300 service taps none are metered. There are 35 fire hydrants in the village. The average domestic consumption, as estimated at the time of the installation of the chlorinating apparatus, is one-fourth million gallons, or 220 gallons per capita per day. The village has no sewerage system, being served by cesspools, privies, and private sewers, the latter discharging either into Paper Mill brook, a tributary of the Unadilla river, or directly into the river.

The 14-inch intake pipe at the large reservoir is near the gate house and located at the bottom of the reservoir at a depth of some 20 feet. Trouble is often experienced with algae growths in the large open reservoir. This has been overcome either by adding copper sulphate or by drawing off all the water of the reservoir into the brook. The spring reservoir, which is covered by a wooden roof, is divided into two parts: The Howard brook end, which is of concrete, and 30 feet x 60 feet in plan and 5 feet 4 inches deep; and the spring fed part, which is of open masonry, 25 feet x 60 feet in plan and 5 feet deep, giving a total capacity of 128,000 gallons. There is an equalizer pipe so that the water in the two parts combine before being delivered to the mains.

A Wallace & Tiernan chlorinating apparatus was installed in June, 1920. With the 1½ pulsations per minute noted at the time of the inspection, and on a basis of 250,000 gallons per day, the rate of application of chlorine was 0.23 p.p.m. The exact amount of chlorine to be added depends, however, on the organic matter in the water to be chlorinated, and it is generally desirable to determine the proper amount by frequent tests for excess chlorine, instructions for making which are issued by this Department.

From the recent investigation made it appears that the recommendations set forth above have been partially carried out. A chlorination plant has been installed to sterilize the present supply, but no steps have been taken either to procure a new supply, adequate in quantity and satisfactory in quality, or to construct a filter plant properly to treat their present supply. Although proper sterilization destroys practically all pathogenic bacteria, it does not affect the physical quality of a water. Since the supply is taken from a source apparently subject to gross pollution at times, it would seem desirable that a filtration system should be installed to treat the water.

As a result of the reinspection of the public water supply of New Berlin it was concluded that the public water supply was not of entirely satisfactory sanitary quality at the time of the inspection; that the chlorinating apparatus recently installed is not effectively sterilizing the water supply; that the village authorities have only partially carried out the previous recommendations of this report. It was therefore recommended that the village authorities apply chlorine to the water continuously and in sufficient quantity effectively to sterilize it; that frequent tests be made of the chlorinated water for excess chlorine in accordance with the directions issued by this Department, and the rate of application of the chlorine be regulated in accordance with the results of the test; and that the village authorities either remove all sources of pollution on the watershed or install a modern filtration plant.

NIAGARA FALLS

A reinspection of the water supply of the city of Niagara Falls was made on March 19, 1920, by Mr. Earl Devendorf, assistant engineer. Previous inspections of this supply were made by this Department in 1907, 1915, and 1916.

Niagara Falls is a city of some 60,000 inhabitants located at the site of Niagara Falls on the Niagara river. There are two public water supplies in the city, one owned by and operated under the direction of the Western New York Water Company, and the other owned by and operated under the direction of the city authorities.

The supply furnished by the Western New York Water Company is derived from the intake canal of the Niagara Falls Power Company, and the purification and pumping plant is located in the southern part of the city on the banks of the canal adjacent to the intake. Water is pumped, after preliminary sterilization by liquid chlorine, from the intake well into a coagulating basin, and flows by gravity through 14 mechanical gravity filters into a clear water well. From the clear water well the water is pumped, after secondary sterilization with liquid chlorine, into the distribution system. The excess over the consumption goes to a steel standpipe 40 feet in diameter and 80 feet in height, having a total capacity of 750,000 gallons. Approximately 25 per cent of the total population of the city is served with this supply. The average total daily consumption during 1919 was 8,091,879 gallons.

Sulphate of alumina is introduced into the raw water as it enters the coagulating basin in various amounts ranging from a minimum of .47 to a maximum of 3.5 grains per gallon depending upon the turbidity of the raw water. This basin has a capacity of 500,000 gallons giving a period of sedimentation from 1.79 to 1.22 hours. The filters are operated with 3 to 3½ feet of water over the sand. Under normal conditions the filter run varies from 12 to 20 hours. At the time of the inspection, however, the run was much shorter, it being necessary to wash the filters about every 4 hours. The filters are washed when the loss of head is equal to 7 feet. The average amount of wash water used is equivalent to 6.4 per cent of the filtered water. After washing, the filtered water is wasted for approximately 10 minutes. The average amount of liquid chlorine used per million gallons for the year 1919 was 2.57 pounds, of which approximately 2 pounds was applied before filtration. The average rate of filtration was 103,000,000 gallons per acre. and ranged from a minimum of 95,000,000 gallons per acre to a maximum of 150,000,000 gallons per acre per day.

At the time of the inspection the matter of cross-connections of the public water supply system with auxiliary fire supplies was taken up. It was learned that at the manufacturing plants of the Carborundum Company, Oldberg Electro-Chemical Company, Niagara Alkali Company, and the National Electrolytic Company, there are cross-connections existing between the public mains and private mains used for fire purposes, which mains are supplied with raw water from the Niagara river and the Power canal. In all of the above plants there are double check valves installed to prevent any raw water from entering the mains of the public supply; and in addition, gate valves with indicator parts are provided in two of the plants, namely the Carborundum Company and the National Electrolytic Company. In all cases the two systems should be separated by gate valves in addition to the double check valves according to the plan approved by the Board of Underwriters.

It was therefore recommended that all existing cross connections between the city mains and private fire lines be equipped with double check and gate valves in accordance with plans approved by this Department, and that the filtration plant be operated with care and efficiency and under careful supervision in order that a supply of satisfactory sanitary quality be furnished to the consumers at all times.

The water of this supply is used by The New York Central Railroad Company for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on December 18, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were fairly satisfactory, and that the results of the inspection and the analyses of the samples, together with the results of previous inspections and analyses, indicate that the water was of satisfactory quality. A copy of the report accompanied this data.

The municipal water supply of the city is obtained from the Niagara river at a point about 2 miles north of the main portion of the city, through an intake extending some 2,200 feet from shore. The water is conducted to a pump well located on the bank of the river near the pumping station, from which it is lifted to the coagulation basins at the filter plant. The water is treated with alum, applied at a rate of about 0.4 grains per gallon, before entering the basins. From the coagulation basins the water flows by gravity to 16 14½ by 25 feet mechanical gravity filters, from which it is discharged into the clear water basin. The filter effluent is sterilized by means of hypochlorite of lime, applied at the average rate of about 3.16 pounds per million gallons. From the clear water basin the water is forced into the distribution mains, consisting of about 90 miles of castiron pipe varying from 4 to 36 inches in diameter. The average consumption is about 12,000,000 gallons per day.

On the morning of February 25, 1920, a break occurred in the mains, and due to heavy drought it became necessary to supplement the filtered water by raw water until February 27. The amount of raw water used never exceeded 18 per cent of the total pumpage. During this period the amount of hypochlorite applied to the water was increased to avoid any possibility of pathogenic bacteria reaching the consumers.

As a result of the inspection it was concluded that the introduction of raw water into the clear water well and thus into the distribution system between February 25 and 27, 1920, was unavoidable, and that during this period the rate of application of hypochlorite was so increased as effectively to sterilize the supply, and that the plant was being carefully operated under scientific laboratory control. It was accordingly recommended that the authorities continue, as in the past, to operate the plant under careful supervision in order to secure a water of satisfactory sanitary quality at all times.

NORTH BANGOR

An investigation of the water supply of the village of North Bangor was made on November 20, 1919, by Mr. A. I. Howd, inspecting engineer.

North Bangor is an incorporated village having a population of about 500, located in the northwestern part of Franklin county, in the town of Bangor. The waterworks are owned by the North Bangor Water Company, Inc. The supply is derived from springs about 1¾ miles east of the village, from which the water flows by gravity to the village.

A concrete reservoir 10 feet by 14 feet by 12 feet deep, with a natural earth bottom, is located over the springs and acts as a collecting basin. The concrete side walls rise to a height of 2 to 3 feet above the ground surface, and an overflow pipe is provided at height of 8 feet above the bottom of the reservoir. The reservoir is covered with a small frame building, A 6-inch intake located near the center and bottom of the reservoir is covered by a ¼-inch mesh copper screen. The water flows from the intake by gravity directly into the distribution system.

The reservoir is located about 20 feet south of the state highway running between Malone and North Bangor. A ditch between the road and reservoir carries off the drainage from the road and land adjacent. The land in the vicinity of the springs consists principally of uncultivated open field with a small wooded portion near the springs. About ½ acre of land around the spring is owned by the water company. The nearest building is about 300 feet distant from the springs and at a slightly higher elevation. There were no apparent sources of direct or continuous contamination of the springs or reservoir at the time of the inspection.

The water company owns another spring located on the north side of the highway a short distance east of the reservoir. A concrete wall, built up around this spring forms a basin 6 feet by 6 feet by 9 feet deep, which is provided with a loose plank cover. This spring is located about 30 feet from the state highway and about 200 feet from the nearest house. The spring is not used for public water supply purposes and is not connected in any way with the distribution system.

As a result of the inspection it was concluded that the public water supply of North Bangor is derived from a source which should ordinarily furnish a water of a satisfactory sanitary quality, and it was therefore recommended that the North Bangor Water Company continue to exercise careful supervision over the water supply and make regular and frequent inspections of the springs and reservoir.

NORTH TARRYTOWN

An investigation of the water supply furnished by the Consolidated Water Company of Suburban New York to the villages of North Tarrytown, Ardsley, Dobbs Ferry, Hastings, and Scarsdale was made on August 31 and September 1, 1920, by Mr. Henry Ryon, assistant engineer.

The villages supplied with water by the Consolidated Water Company of Suburban New York are located along the east shore of the Hudson river in Westchester county, from 20 to 25 miles north of New York city. The total population served is approximately 20,000, and the consumption about 3,000,000 gallons per day, or 150 gallons per capita per day. The distribution system consists of approximately 85 miles of castiron mains varying from 4 to 16 inches in diameter, on which there are approximately 2,600 service taps, two-thirds of which are metered. The main supply is derived from the Pocantico river at Pocantico lake. There is, however, a connection to the Croton Aqueduct of New York City's supply at Ardsley, from which water can be taken in case of necessity. The water from Pocantico lake is coagulated, filtered, and chlorinated before being delivered into the mains, and that from the auxiliary supply from the Croton Aqueduct treated with liquid chlorine when used. In addition to the storage in Pocantico lake, which has a capacity of about 383,000,000 gallons, there are three reservoirs: the first, known as the high service reservoir, located a short distance north of the Pocantico station, having a capacity of about 11,000,000 gallons; the second, the Metz farm reservoir, with a capacity of 4,000,000 gallons; and third, the Ardsley standpipe, with a capacity of 60,000 gallons; making the total storage capacity a little less than 400,000,000 gallons.

The watershed tributary to the reservoir has an area of approximately 12½ square miles. There are about 100 houses on the area, most of which are at a considerable distance from the river and its tributaries. There are two sewage disposal plants on the shed—one serving Briarcliff Manor and consisting of settling tanks, a pumping station, and absorption trenches; the other serving St. Joseph's School at Pocantico Hills and consisting of settling tank and subsurface irrigation field. Neither of these two plants discharges its effluent directly into the Pocantico river or its tributaries, and when properly operated the plants cannot be considered as affecting in any way the sanitary quality of the water supply. At Briarcliff Manor, however, some difficulty has been experienced in the past by the overloading of the pumping station after heavy rains, resulting in the direct discharge of settled sewage into the tributaries of the lake. During the present summer, in order to overcome this difficulty, an additional pump has been installed and additional absorption trenches constructed, which make it possible to dispose of all the sewage reaching the plant, even at times of maximum flow, without danger of any sewage or effluent reaching the stream without passing through the soil.

On the south side of a small stream entering the east side of the reservoir, about ½ a mile above the dam, there are two dwellings with the usual accessory buildings, which with the ground around them are not kept in an entirely satisfactory condition. The ground immediately adjacent to the buildings and sloping toward the streams shows evidence of considerable pollution. The sanitary arrangements, however, comply with the rules and regulations enacted for the protection from contamination of the water supply furnished by the Consolidated Water Company of Suburban New York to North Tarrytown and the other villages. The conditions at the time of the present inspection were considerably better than at the time of the previous inspection. It is understood that the property has recently changed hands and it is hoped that the new owner will keep the premises in better condition.

The treatment plant and pumping station of the company is located immediately below the dam, and the water is here treated with alum, allowed to stand in the coagulation basin, filtered through pressure mechanical filters, chlorinated, and pumped into the distribution mains.

Under normal conditions the water flows by gravity from the dam to the chemical house, where alum is applied to it at the rate of about 400 pounds per day, or about 0.9 of a grain per gallon. From the chemical house the water passes to the coagulation basins, which are two in number, each 38 by 90 feet in plan and 12 feet deep, making the total capacity approximately 600,000 gallons, the equivalent of approximately four hours average flow. Each basin is divided by a longitudinal wall which causes the water to flow from the point of entrance to the opposite end and back again to the outlet located opposite the inlet. The basins are operated in parallel. At the time of the inspection a very satisfactory flow existed in the basins. The basins are located at such an elevation that at times of extreme low water their flow line is above the level of the water in the lake. To provide for this condition, which only occurs at infrequent intervals, two 3,000,000 gallon steam driven centrifugal pumps have been installed in the pumping station to lift the water from the reservoir to the chemical house and coagulation basins.

From the coagulation basin the water flows to the filters which consist of six horizontal pressure mechanical units, each about 20 feet by 8 feet in size and having a rated capacity of 500,000 gallons per day. With an average water consumption of 3,000,000 gallons per day, the rate of filtration through these filters is about 110,000,000 gallons per acre per day, a rate which should give satisfactory results. The filters are said to be flushed once each day on the average, although at times when the turbidity of the water and the quantity of alum applied is higher than usual they are of course washed more frequently. No instruments have been installed for measuring the loss of head through the filters, nor is there any apparatus for controlling the rate of filtration except the automatic valve which maintains a constant head on the coagulation basin. It would seem desirable that suitable gauges should be installed for indicating the loss of head through the filters, thus giving an idea of their condition and facilitating their operation. The suction of the pumps connect directly to the main effluent pipe from the filters, thus making the total head on the filters the gravity head due to the elevation of the coagulation basin above the filters plus the vacuum on the suction of the pumps.

A Wallace and Tiernan manual control chlorination apparatus is provided for applying chlorine to the filtered water and is connected to the suction pipe between the filters and the pumps just mentioned. At the time of the inspection the manometer on the chlorination apparatus indicated that the chlorine was being applied at the rate of 8.1 pounds per day, which taken in connection with the fact that the Worthington pump described below was operating at 36 r. p. m. made the rate of application 0.32 p. p. m. Scales are provided under the cylinder for checking the rate of application of the chlorine, and a duplicate chlorinating apparatus is kept at the station for use in case of emergency.

Daily routine analyses of the water are made by the attendant at the filtration plant for the control of its operation. These analyses consist of examinations for alkalinity and bacterial counts of the raw and filtered water and presumptive test for B. coli. Weekly check analyses are made at the laboratory of Hill and Ferguson in New York city.

The condition of the Pocantico reservoir and the three smaller reservoirs was fairly satisfactory at the time of the inspection. They were all free from algae growths and the water appeared to be clear and colorless. The condition of the sides of the high pressure reservoir has been considerably improved since the time of the last inspection by the removal of the brush which formerly grew in the riprap at and above the water line. It is understood that the Pocantico reservoir has been treated with copper sulphate every two weeks during the present season and that the treatment has been successful in preventing the growth of algae. The copper sulphate used has been applied in a powdered form.

At the time of the inspection the water in the different villages appeared to be of satisfactory sanitary and physical quality, no tastes or odors being apparent at any point. In the northern part of Scarsdale, however, at the end of the lines of the company, it is understood that some difficulty has been experienced from tastes, odors, and color. An examination of the water, however, at this point at the time of the inspection did not reveal such a condition. The engineer from this Department visited the house of one of the complainants in this section and was told that the water had been unsatisfactory, but at the time of the inspection and for two or three days prior no difficulty had been experienced. Since this district is at the end of the lines of the company at a point where there is no circulation, it is probable that the color, tastes, and odors complained of are due to the fact that the water lies in the pipes for a considerable time and takes up iron from them. The analyses of the samples of the water bear out this conclusion. The iron content of the water at the plant is comparatively low, while that of the water taken from the hose tap in a Mr. Kuss' house, where it had probably stood in the pipe for some time, was high. The superintendent of the water company stated that he had been flushing these pipes at very frequent intervals in order to improve the condition, and the street commissioner of Scarsdale confirmed this statement. It would appear that the flushing of these pipes should be done at frequent intervals in order to keep the water in this section in a satisfactory condition.

The health officers of the four villages supplied, when interviewed by the representative of this Department, stated that the quality of the water had been fairly satisfactory for the past year and that they had received very few complaints regarding it.

As a result of the investigation it was recommended that the Consolidated Water Company of Suburban New York continue to maintain careful supervision over the condition of the watershed from which the supply is derived and over the operation of the plant, and that they frequently flush those mains where there is little circulation in order to prevent the water from lying in the pipes for any length of time and thus deteriorating in quality.

NORTH TONAWANDA

The method of chlorinating the water supply of North Tonawanda was inspected by representatives of the Engineering Division on January 21 and October 19, 1920. These inspections were made primarily because of outbreaks of typhoid in the city during previous years, due to the failure of the chlorinating apparatus to operate. At the time of these inspections it was found that chlorine was being satisfactorily applied to the water.

OCEAN BEACH

An inspection of the public water supply of the village of Ocean Beach, Suffolk county, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on May 26, 1920.

Ocean Beach is located on Fire Island, about 6 miles southwest of Bay Shore, and is a summer resort having a summer population of about 3,500. The entire population is served with water from the public supply, which is owned and operated by the Ocean Beach Water Company.

The water supply is obtained from shallow wells located about 2,000 feet south of the boat landing, and about 300 feet north of the Atlantic ocean. From the wells the water is delivered by pumping through a distribution system consisting of about 3 miles of castiron pipe, the surplus going to a small tank having a capacity of about 25,000 gallons. The wells consist of five 4-inch and three 2-inch driven wells, 20 feet deep, placed 40 feet apart, north of the pumping station. There are apparently no sources of pollution within the vicinity of the wells. The houses are connected to a sewerage system and the sewage disposed of through a sewage disposal plant located east of the boat landing. The water company owns a plot of ground about 50 feet by 80 feet in size, which has not been fenced to prevent trespassing.

As a result of the inspection it was concluded that the public water supply was of a reasonably satisfactory sanitary quality, but that certain possibilities for local contamination of the supply existed; and it was therefore recommended that the authorities in charge of the supply exercise careful supervision over the area in the vicinity of the wells, and that the land owned by them around the wells be fenced to prevent trespassing.

OSSINING (Sing Sing Prison)

Amended plans for a water supply system at Sing Sing prison, Ossining, N. Y., were submitted to this Department for approval by the State Architect on January 26, 1920. The plans comprise State Architect's drawings Nos. 2138, 2139, 2140, 2159, 2105, and 2107, approved by this Department on July 7, 1918; and drawing No. 2106, approved by this Department on May 25, 1918. The amendments consisted of minor changes in the location of the lines, and the incorporation of the line to the mess hall, formerly shown as a future extension, the installation of a cross-connection between the low pressure systems, and the installation of chlorination apparatus for treating that part of the supply taken from the Croton Aqueduct. After careful consideration by the Engineering Division, plans were approved on February 11, 1920.

OWEGO

A reinspection of the public water supply of the village of Owego, Tioga county, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on March 25, 1920, previous inspections of the supply having been made by this Division in 1912 and 1915.

Owego is a village of about 5,000 inhabitants, located in the south-central part of Tioga county, 20 miles west of the city of Binghamton. About 80 per cent of the total population are served by the public water supply. The waterworks are owned and operated by the Owego Water Works Company.

The water supply is derived from two sources: Barnes creek, an upland stream northeast of the village, and two shallow dug wells in lowland in the northwestern part of the village. The creek supply, after treatment by coagulation and mechanical filtration, is distributed by gravity to the village. The well supply is pumped directly into the system against a head maintained by the clear water reservoir at the filter plant. The average daily water consumption is said to be approximately 700,000 gallons, or about 175 gallons per capita per day.

As a result of the reinspection it was concluded that the authorities in charge of the water supply have not carried out all of the recommendations of our last report, that the filtration plant as operated could not be depended upon to produce a satisfactory water at all times, that there were certain opportunities for serious contamination of the well water supply, and that although the apparatus for sterilization of the water by liquid chlorine had been ordered, it was not in place at the time of the inspection. It was therefore recommended that the Water Works Company carry out, without delay, the recommendations of our previous reports regarding the improvement of the present supply or the securing of a new one, and that liquid chlorine be applied to the water at all times in such quantities as properly to sterilize it.

OXFORD

A reinspection of the public water supply of the village of Oxford, Chenango county, N. Y., was made by Mr. N. H. Baier, sanitary inspector in this Department, on November 22, 1920, previous inspections of the supply having been made by this Division in the years 1916 and 1917.

Oxford is located on the Chenango river in the north-central part of the town of Oxford, about 33 miles north of Binghamton. The population is approximately 1,590, of which about 75 per cent is served by the public water supply. The waterworks are owned by the village and operated under the control of a board of water commissioners.

The water of the main supply is derived from springs developed by the construction of three basins located on a sidehill about 4 miles north of the village, and is delivered to the consumers by gravity through a distribution system consisting of about 12 miles of castiron pipe. A reservoir of about 250,000 gallons capacity, located approximately one-fourth of a mile north of the village, takes the surplus water and acts as an equalizing reservoir.

The apparent watershed of the spring is approximately 0.2 of a square mile in area and is for the most part used for pasture or cultivated. There are no houses on the shed. The area surrounding the springs is fenced. An inspection of the springs and their surroundings is said to be made by the superintendent of the waterworks every few weeks.

In order to augment the spring supply, a 6-inch well about 300 feet deep was drilled a few years ago, but has since been abandoned because its capacity was only about 15 gallons per minute. The well of the Borden's Condensed Milk Company, about 65 feet deep, is however, being regularly used as an auxiliary source of water supply. This well is unsatisfactorily located in the fairly well built-up portion of the village. where it is possible that pollution may at times reach the water. The village is also contemplating using the water from the well of the Rural Products Company, which is 151½ feet deep, the first 100 feet passing through clay and broken rock, and the remaining 51½ feet through solid bluestone rock. The casing is said to extend to the bluestone.

The analyses of samples of water taken August 2, 1920, show the water to contain active contamination. This may, however, have been due to the fact that the well had recently been drilled and not used to any extent.

A later sample indicated that the water was free from active contamination at the time it was taken.

As a result of the inspection it was concluded that the regular or spring supply of the village was of satisfactory sanitary quality at the time of the inspection, but that it is necessary at times to use water from auxiliary sources which are not entirely satisfactory. It was therefore recommended that the present careful supervision of the regular or spring supply by the village be continued, and that steps be taken to secure an auxiliary supply of satisfactory sanitary quality.

OXFORD (Women's Relief Corps Home)

An inspection of the water supply of the New York State Women's Relief Corps Home, at Oxford, Chenango county, N. Y., with special reference to the devolpment of a new source of supply, was made by Mr. W. C. Emigh, assistant engineer in this Department, on July 19, 1920.

As a result of this investigation it was concluded that the development of an additional water supply by using the suction well near the power plant of the institution was inadvisable on account of the potential sources of contamination in the vicinity, and it was recommended that as far as possible the present sources of water supply be protected from contamination, as recommended in the report on the investigation of March, 1920; that the water from the suction well near the power plant be not pumped into the institution mains for drinking or culinary purposes; that a test well be sunk on the hillside above the power house; and that a series of analyses be made of the water from this test well to determine its suitability as a water supply for drinking and culinary purposes.

OYSTER BAY

A reinspection of the public water supply of the unincorporated village of Oyster Bay, Nassau county, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on June 15, 1920, previous inspections of the supply having been made by this Division in 1915 and 1918.

Oyster Bay is located in the northeast corner of the town of Oyster Bay, about 35 miles east of New York city. The population is estimated at about 5,000, of whom only about 25 per cent are served by water from the public supply. The waterworks are owned and operated by the Nassau Water Company.

The supply is derived from three 8-inch driven wells located in the southwestern part of the village. Two of the wells, one 398 feet and the other 500 feet deep, are directly connected to the pump suction. The other well. 497 feet deep, is a flowing well, discharging into a small concrete receiving chamber about 15 by 25 feet in plan and 10 feet deep, from which the water is taken by pumps. The wells are rather unfavorably located in a depression which apparently receives the drainage from the toilets of the surrounding territory. There are some 18 or 20 houses east of the plant within a radius of 500 feet, all located on higher ground than that on which the wells are drilled. The nearest houses are about 150 feet east of the wells. None of the houses have sewer connections. Some are provided with earth vault privies and some with leaching cesspools. The engineer's residence is located in the second story of the pumping station, and the sewage is discharged into the cesspool some 7 feet west of the pumping station. About 100 feet west of the pumping station is the Mill Pond creek, and while it is said that the water never rises high enough to reach the ground around the wells, it seems probable that after heavy storms this stream may be a possible source of pollution.

A Wallace & Tiernan manual control solution feed chlorinator was installed in 1918. At the time of the inspection, however, the apparatus was not operating, due to the fact that it was impossible properly to regulate the amount of chlorine flowing to the solution chamber.

Samples of the water were taken at the time of the inspection and sent to the Division of Laboratories and Research for examination. The results of the bacterial examination of these samples show very high counts, and the presence of bacteria of the colon group in nearly all of the inoculations tested, including one of the 1/10 c.c. inoculations, indicating that the water contained active contamination at the time the samples were taken.

As a result of the inspection it was concluded that the water company had not carried out the recommendations of this Department, and that the water supply of the village was receiving pollution and was not of satisfactory sanitary quality at the time of the inspection. It was therefore recommended that the chlorination apparatus be immediately repaired, and that chlorine be applied to the water continuously in proper proportions at all times; that duplicate apparatus be secured and kept at the pumping station in order to insure continuous operation; that as far as possible all sources of pollution in the vicinity of the wells be removed; and that the well casings and suction lines be examined for leaks, and all leaks discovered be immediately and effectively stopped.

PATCHOGUE

A reinspection of the water supply furnished by the Great South Bay Water Company to the village of Patchogue, and the unincorporated villages of Bay Shore, Islip, East Islip, Great River, Sayville, West Sayville, Bayport, and Blue Point, Suffolk county, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on May 24 and 27, 1920, a previous inspection of this supply having been made by this Division in 1918.

The villages supplied are located along the south shore of Long Island in the vicinity of Patchogue, and have a total population of about 25,000, approximately 75 per cent of which is served with water from the public supply.

The water is derived from driven wells, part of which are located in the northwestern section of Bay Shore about one-half mile northwest of the railroad station, and part in the northwestern section of Patchogue on the north side of the Long Island railroad about one-fourth of a mile west of the Patchogue river. The water is delivered by pumping into a distribution system of about 100 miles of castiron pipe, to which are connected 4 steel standpipes which act as equalizing reservoirs. The total water consumption in winter is approximately 1,500,000 gallons and in summer about 2,700,000 gallons, the average consumption being equivalent to about 115 gallons per capita per day.

The wells at Bay Shore consist of twelve 10-inch, six 8-inch, and eight 5-inch driven wells, all of which are about 60 feet deep. The eight 5-inch wells are to be abandoned, and four 8-inch wells, which are now being driven, connected to the system. Concrete pits, 4 feet square and 5 feet deep, similar to those now surrounding the 10-inch wells, will be constructed about the new wells. At Patchogue the driven wells consist of fifteen 10-inch wells, about 50 feet deep, of which ten wells are now in use. The wells are surrounded by wooden boxes and located in a plot of ground about 300 feet by 800 feet in size, which is situated in the built-up portion of the village.

As a result of the reinspection of the public water supply of the Great South Bay Water Company, it was concluded that the company has only partially carried out the previous recommendations of this Department, and that while the analyses of samples of water taken at the time of the inspection did not show active contamination, certain potential sources of contamination existed and that the water might become actively contaminated at any time. It was therefore recommended that the water company maintain careful supervision over the area in the vicinity of the wells to prevent incidental pollution of the ground; that watertight containers be provided for all privies within a radius of 500 feet of the wells at both plants; that all cesspools within that distance be made watertight, and that the containers and cesspools be properly cleaned at frequent intervals and the contents disposed of in some remote place. It was also recommended that the water company, in cooperation with the village authorities, consider the installation of a properly designed sewer system for the area in the vicinity of the wells, and the subsequent elimination of all privies and cesspools in the vicinity of this area.

PEEKSKILL

A reinspection of the water supply of the village of Peekskill was made on August 4, 1920, by Mr. A. I. Howd, assistant engineer. A previous inspection of this supply was made by this Department in 1917.

Peekskill is an incorporated village having a population of 16,200, located about 40 miles north of New York city. Of the total population, about 90 per cent are served with water from the public water supply. The waterworks are owned and operated by the municipality under the direction of a board of water commissioners.

The water supply is derived from Peekskill Hollow creek, the intake being located about 2 miles northeast of the village. The water is pumped from Peekskill Hollow creek through a 12-inch and 20-inch force main to a 30-million gallon storage and sedimentation basin on a hill about 1 mile south of the village. The water flows from the basin through a gate house and screen chamber provided with a ¼-inch mesh screen, and through a 16-inch pipe to an aerator in a circular concrete basin 30 feet in diameter and 10 feet deep below the water level. The aerator consists of a 16-inch riser capped with a plate perforated with 1-inch holes. The water flows from the aerator to four units of covered slow sand filters, each unit having dimensions of 65 feet by 143 feet, or a total area of 0.850 acres. The filtering medium consists of successive layers of 18 inches of coarse stone, 12 inches of 1½-inch stone, 10 inches of gravel, and 36 inches of sand. The filters are provided with loss of head gauges and the rate of filtration is controlled by hand operated valves.

The rate of filtration with the average consumption is almost 4,000,000 gallons per acre per day, but at times of maximum draft, particularly when one bed is cut out for cleaning, the rate considerably exceeds this figure.

The water flows from the filters into a covered clear water well which had dimensions of 43 feet by 160 feet by 10 feet deep, and a capacity therefore of 516,000 gallons. The water flows by gravity from the clear water well through a 12-inch and a 16-inch main to the village.

As a result of the above inspection it was concluded that Peekskill Hollow creek, the source of water supply of Peekskill, is subject to direct and indirect pollution from the population on the watershed; that certain violations of the rules and regulations enacted by this Department exist; and that the filter plant was being carefully operated at the time of the inspection. It was therefore recommended that the authorities in charge of the water supply strictly enforce the rules and regulations enacted by this Department for the protection of their source of water supply from contamination; that they continue their careful supervision of the operation of the filtration plant, and that they install apparatus for the sterilization of the supply with liquid chlorine at times when the filters are operated at very high rates.

The water of this supply is used by the New York Central Railroad for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on November 12, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were satisfactory and that the results of the inspection and the analyses of the samples, together with the results of previous inspections and analyses, indicate that the water was of satisfactory quality for human consumption at the time of the inspection. A copy of the report accompanied this data. Based on this information the United States Public Health Service on November 17, 1920, issued a certificate permitting the use of the water for drinking and culinary purposes in interstate traffic.

PETERSBURG

A reinspection of the water supply of the village of Petersburg was made on October 11, 1920, by Mr. W. J. Erickson, sanitary inspector. A previous inspection of this supply was made by this Department in 1917, the report upon which is published in the Annual Report of the Department for that year.

Petersburg is an unincorporated village of 200 inhabitants located in the eastern part of Rensselaer county about 18 miles east of Troy. The waterworks are under the control of the Petersburg water district. The village is not provided with public sewers.

The supply is ordinarily derived from a small stream tributary to the Little Hoosick river known as Fly creek, and a small tributary thereto. The intakes are located about half a mile west of the village. An auxiliary supply is derived from a dug well on the westerly bank of the river in the northeastern part of the village.

An earthen dam with a concrete core wall has been constructed across Fly creek forming a storage reservoir. This reservoir is about 150 feet wide and 200 feet long and on an average 6 feet deep, with a storage capacity of about 1,300,000 gallons. As the dam is constructed on sand and gravel a considerable amount of water leaks through the bottom. The tributary or southern watershed is developed by the construction of a small intake basin on the tributary below the storage reservoir from which the supply goes directly to the mains as there is no storage. When this supply is used the pipe leading from the main reservoir is closed as the intake on this line is at a lower elevation. The southerly intake was in use at the time of the inspection.

The well is located about 22 feet from the Little Hoosick river. It is about 4½ feet square and 9 feet deep, and covered with timber and about 2 feet of earth. The ground water undoubtedly receives some pollution from the various houses and privies located above the well, and from infiltration from the Little Hoosick river which receives pollution, largely indirect, from farm houses and small hamlets on its watershed. As to whether there would be sufficient purification of the water at times when there is a heavy draft on the well and consequently a more rapid infiltration is indeterminable with the data on hand. There are about 5 houses with a population of about 25 within 500 feet, and 12 houses with a population of about 50 within 1,000 feet of the well.

The analysis of samples at the creek supply shows a water that is somewhat colored, practically clear and soft. The amount of organic matter is moderate as shown by the ammonia compounds. The northerly branch shows a freedom from active contamination while the southerly branch shows high counts and organisms of the B. coli type in all three 1 c. c. inoculations.

The analysis of the well supply shows a water that is clear, slightly turbid, and moderately hard. The amount of organic contamination is considerable and is apparently of animal origin as indicated by high figures for the ammonia compounds, particularly that for the free ammonia and nitrites. The figure for chlorine is higher than that for ground waters of this vicinity. The total bacterial count is low and organisms of the B. coli type are absent.

As a result of the inspection it was recommended that no cattle be allowed to pasture within 50 feet of the reservoir; that the south branch of Fly creek be abandoned as a source of supply, unless suitable and adequate methods be provided for its purification, and that the well be abandoned; and if necessary, an additional supply of satisfactory sanitary quality be obtained by the development of a new source free from pollution, or a well or wells at least 50 feet from the river and remote from other possible sources of pollution.

PHOENICIA

A reinspection of the water supply of the village of Phoenicia was made on October 25, 1920, by Mr. W. J. Erickson, sanitary inspector. A previous inspection of this supply was made by this Department in 1916, the report upon which is published in the Annual Report of the Department for that year.

Phoenicia is an unincorporated village located in the northern part of Ulster county, on the Ulster and Delaware railroad, 23 miles northwest of Kingston. The village has a resident population of about 450 which is increased to about 1,100 in the summer months. About 80 per cent of the population is served with water from the public supply, which is owned and operated by the Phoenicia Water Works Company. There is no public sewerage system, the houses being served by privies and cesspools.

The water supply is derived from springs located about a mile east of the village. From the springs the supply is conducted to a 150,000-gallon storage reservoir from which it flows by gravity through about 2½ miles of mains to the consumers. During the summer the regular supply is supplemented from Muddy creek, the intake being located about a mile and a-half west of the village.

The springs, 6 in number, are located in a ravine on the slopes of Trumer mountain. There is some possibility of surface wash entering them particularly one which is fed by a spring brook. As the watershed is unpopulated, heavily wooded, practically inaccessible, there is practically no possibility of contamination except from animals crossing the watershed.

The watershed tributary to Muddy brook above the intake is about a mile and a-half in area. This area is located on the side of Garfield mountain and is rather steep and almost entirely wooded. There is but one house on the watershed, which is occupied only during the summer months. The privy is located about 200 feet from the stream and is provided with a concrete vault. It seems probable that if this place is kept in a proper sanitary condition there is little danger of serious pollution from this source. There is, however, as in all surface supplies, the ever present possibilty of contamination from animals and from visitors on the watershed. This brook cannot be considered an entirely satisfactory source of supply unless very carefully inspected at frequent intervals and protected from possible pollution.

As a result of this inspection it was recommended that frequent inspections of the watersheds of the supply be made in order to detect and abate any source of pollution found thereon, and that should any difficulty be experienced in carrying out this recommendation, application be made to this Department for the enactment of rules and regulations for the sanitary protection of the supply.

The water of this supply is used by the Ulster and Delaware Railroad for drinking and culinary purposes. Data regarding this supply were furnished to the United States Public Health Service on November 23, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were satisfactory, and that the conditions surrounding the auxiliary supply were not entirely satisfactory. The results of the inspection and analyses of the samples of water, together with results of previous inspections and analyses, indicate that the water of the main supply was of satisfactory quality for human consumption, but that the water of the auxiliary supply, used in summer only, cannot be considered of an entirely satisfactory quality unless very carefully inspected at frequent intervals and protected from possible pollution. A copy of the report accompanied this data. Based on this information the United States Public Health Service on November 30, 1920, issued a certificate permitting the use of the water from the main supply for drinking and culinary purposes in interstate traffic, and also a certificate prohibiting the use of the auxiliary supply in cars engaged in interstate traffic.

PHOENIX

A reinspection of the water supply of the village of Phoenix was made on July 7, 1920, by Mr. Earl Devendorf, assistant engineer. A previous investigation of the supply was made by this Department in 1914.

Phoenix is an incorporated village of about 2,000 inhabitants located in the southwestern part of Oswego county, about 20 miles northwest of the city of Syracuse. The public water supply is owned and operated by the village under a Board of Water Commissioners.

The water supply is obtained from the Oswego river, from which the water is pumped direct to the distribution system, the excess over consumption going to a standpipe located in the village. The watershed of the Oswego river above Phoenix covers many square miles and receives the indirect sewage from the inhabitants on the watershed as well as the direct sewage of the cities and villages, the larger of which are the city of Syracuse and the village of Baldwinsville.

The fire supplies of the Oswego River Paper Mill, the Three River Paper Mill, and the Phoenix Toilet Paper Company are pumped from the river and are cross-connected to the village supply. While the cross-connection makes little difference at the present time, as the public supply is obtained without purification from the river, when the supply is treated or a new safe supply obtained the connection should be eliminated or equipped with a double check and gate valve.

As a result of the above investigation it was concluded that, as pointed out in the previous report, the Oswego river is grossly polluted and its water unfit for human consumption without adequate purification; and it was therefore recommended that the village authorities install a suitable treatment plant, or obtain a new water supply adequate in amount and of a satisfactory sanitary quality, and that pending the installation of a new supply of safe sanitary quality the village authorities warn the public not to use water from the public supply for drinking or culinary purposes.

PINE PLAINS

A reinspection of the water supply of the village of Pine Plains was made by Mr. W. J. Erickson, engineering assistant, on May 21, 1920. A previous inspection of this supply was made in 1915.

Pine Plains is an unincorporated village of about 850 inhabitants located in the town of Pine Plains, in the northern part of Dutchess county, near the headwaters of Wappingers creek. Practically all of the inhabitants use the public water supply which is owned by Pine Plains Water Company.

The supply is derived from springs located on the slope of Stissing mountain, about 2 miles west of the village, and from a well located near the foot of a hill in the southeastern part of the village below the reservoirs, the latter source being used only in times of drought when the springs fail. The supply from the springs flows by gravity to the distribution system and the reservoirs.

The spring supply is derived from two springs from which the water flows to a collecting basin. The springs and collecting basin are covered with wooden roofs and surrounded by a masonry wall. The roof of the collecting basin was in bad repair at the time of the inspection. The springs are located in shale and there is practically no top soil. The area tributary to the springs is approximately half a square mile in area. There are no houses on this area and probably the only pollution would be from animals in the wood and from passing hunters. The yield in time of drought is materially decreased and it becomes necessary to supplement by pumping from the well.

The well is located in the southeastern part of the village near the foot of the hill on which the reservoirs are located. This well which is 6 inches in diameter and 300 feet deep was drilled through solid bluestone rock for the entire distance, except for about 2 feet of top soil. It is cased for the entire distance and a concrete curb prevents the water from leaking back into it. The well and pumping equipment is housed in the cellar of a frame building the upper section of which is used for storage.

The company owns about one-quarter of an acre immediately above the well and there are no houses located there. The nearest house is about 75 feet from the well and at a higher elevation than the well. The drainage, however, is not in the direction of the well. The privy of this house is about 200 feet from the well. There are two other houses slightly lower than the well, about 150 feet from it. The privies of these houses are 150 feet and 300 feet from the well respectively. The well had not been in use for some time previous to the inspection.

As a result of the inspection it was concluded that the water derived from the springs was of a satisfactory sanitary and physical quality at the time of the inspection, but that the new well supply was liable to contamination from the neighboring houses; and the interior of the pump through leaks in the casing and cracks and fissures in the rock; and that the interior of the well house was not kept in a neat and sanitary condition.

It was therefore recommended that the well house and surroundings be cleaned up, and strict supervision be maintained over the building and the land in the vicinity to minimize the chances of pollution of the well supply.

PLATTSBURG

An investigation of the public water supply of the city of Plattsburg, with special reference to the odors in the water and the method of chlorinating the water, was made by Mr. Henry Ryon, assistant engineer in this Department, September 24, 1920, and November 17, 1920.

The unsatisfactory physical quality of the water seemed for the most part to have been due to growths of algae, protozoa, and other organisms in the reservoirs. The removal of the plants of the higher organisms, and the dredging and draining off of some of the shallow parts of the reservoirs would undoubtedly be a desirable improvement which would prevent to some extent the growths of these organisms but would undoubtedly be very expensive. It seems desirable, however, that some attention should be given to this matter and that the aquatic plants be removed as far as possible, and those parts of the reservoir where water lies stagnant in shallow pools eliminated. The growths of these organisms can be prevented by the application of copper sulphate in proper proportions, and since this treatment is comparatively inexpensive, it would seem advisable that it should be carried out each year before the appearance of the organisms and continued until the danger of their appearance is past.

The chlorination of the water supply as now carried on, while it undoubtedly greatly reduces the danger of waterborne disease in the city, cannot be considered as entirely satisfactory. The chlorination plants are located at remote places where it is difficult to give them proper attention, particularly in winter, with the consequent danger of interruption of the service, and there is no means of measuring the flow of water and regulating the application of chlorine in proportion to the flow. It has been recommended that a single chlorination plant and a Venturi meter be installed at the receiving basins. By this change the chlorination plant will be placed where it will be easily taken care of, the flow of water measured, and the application of chlorine regulated accordingly.

Samples of water were taken at the time of the inspection and sent to the Division of Laboratories and Research for examination. The result of the examination of these samples indicated that the water of both Mead and West brooks contained active contamination at the time these samples were taken, and that the chlorinated water as taken from the tap in the city also contained active contamination.

As a result of the investigation it was recommended that a chlorinating plant for sterilizing all the water taken from both West and Mead brooks be installed and put in operation without delay; that a suitable apparatus for measuring the flow of water be installed in connection with the chlorination apparatus; that chlorine be applied to the water continuously at all times in such proportions as effectively to sterilize it. It was also recommended that the reservoirs be as far as possible cleared of aquatic growths, and that they be treated with copper sulphate each year to prevent the growth of algae.

The water of this supply is used by the Delaware and Hudson Railroad for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on October 18, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were not entirely satisfactory, and that the results of the inspection and analyses of the samples, together with the results of previous inspections and analyses, indicate that the water cannot be considered to be of satisfactory quality for human consumption until the chlorinating plant is installed, as recommended. Based on this information the United States Public Health Service on November 11, 1920, issued a certificate stating that the use of the water for drinking and culinary purposes in interstate traffic was not permitted.

POINT O'WOODS

An inspection of the public water supply of the unincorporated village of Point O'Woods, Suffolk county, was made by Mr. Alfred Mullikin, assistant engineer in this Department, on May 25, 1920.

Point O'Woods is located on Fire Island, in the southern part of the town of Brookhaven, about 60 miles from New York city. The settlement is made up almost entirely of summer visitors. The waterworks are owned and operated by the Point O'Woods Association.

The water supply is derived from 10 driven wells located in the southern part of the settlement about 400 feet north of the Atlantic Ocean. These wells are driven to a depth of about 20 feet through a stratum of fine sand, increasing in size to a coarse gravel. The area around them, owned by the Association, is not fenced to prevent trepassing. The density of the population within a distance of about 500 feet of the wells is approximately 180 per square mile. The settlement is provided with several subsurface irrigation sewage disposal plants located about 1,000 feet north of the wells. The water supplies seem to be fairly well protected from contamination, with the exception of the fact that the soil in the vicinity might be polluted by trespassers and that leakage from nearby sewers might possibly reach this supply.

As a result of the inspection it was recommended that the Association authorities relay such tile sewers as pass within 500 feet of the wells with castiron pipe with lead joints, and that a reasonable area in the vicinity of the wells be enclosed by a fence to prevent trespassing.

PORT HENRY

A reinspection of the water supply of Port Henry was made by Mr. W. J. Erickson, engineering assistant in this Department, on September 4, 1919, previous inspections of the supply having been made by this Division in the years of 1915 and 1918.

Port Henry is an unincorporated village in Essex county, located on the west shore of Lake Champlain, about 117 miles north of Albany. It has a population of about 2,600 people, most of whom are served by the public supplies. There are two supplies, one owned and operated by the village; the other known as the Witherbee supply, owned and operated by the estate of J. G. Witherbee. This latter supply is used by only about 6 per cent of the population.

The municipal supply is derived from Bartlett brook and a spring located about 3 miles north of the village. The water from Bartlett brook is delivered through a 3-inch pipe from a diverting dam into a small collecting basin. The water from the spring is carried through a 6-inch pipe from a small collecting basin to a 6-inch pipe from the Bartlett brook collecting basin. The mixed water is conducted to a settling basin from which it flows to the filters, which have a total area of about 0.09 of an acre and operate at the rate of from 17,500,000 to 25,000,000 gallons per day.

As a result of the inspection it was concluded that the majority of the previous recommendations of this Department have been carried out, and that if properly operated the filters should deliver a water of satisfactory physical and sanitary quality. It was accordingly recommended that a very rigid supervision be maintained over the filter plant and the watershed.

The privately owned supply is derived from 16 springs on the property of the J. G. Witherbee estate. From these springs the water is conducted to two receiving wells from which it flows to a storage reservior one mile nearer the village. From this reservoir it is distributed to the consumers by gravity.

As a result of the investigation it was found that the spring houses were in need of repair, and that the springs were not properly protected from surface wash and trespassers. Since this condition had been pointed out in the previous reports of this Department, it was recommended that those in charge of the supply carry out the previous recommendations of this Department at the earliest possible time.

PORT JEFFERSON

A reinspection of the water supply of the unincorporated village of Port Jefferson was made on June 23, 1920, by Mr. Alfred Mullikin, assistant engineer, a previous inspection of this supply having been made by this Division in 1915.

Port Jefferson is located in the northern part of the town of Brookhaven. about 59 miles from New York city. The present population is estimated at 3,000, of which about 80 per cent are served with the water from the public supply. The waterworks are owned and operated by the Port Jefferson Water Company.

The supply is derived from 4 driven wells located about a mile northwest of the railroad station, in a low part of the village on the bank of the Port Jefferson Harbor. There is one new well which has just been sunk but which has not been connected up to the supply, making in all 5 wells. The water is delivered by pumping through a distribution system consisting of some 8 miles of castiron pipe, the surplus going to a concrete reservoir and a steel standpipe.

The driven wells are located along the east side of the brick building and about 10 feet away from it. Two 6-inch wells 50 feet deep were not being drawn upon at the time of the inspection. One 6-inch well 48 feet deep, and one 6-inch well 55 feet deep, were supplying the water to the village at the time. A new 6-inch flowing well has been driven this year to a depth of 95 feet which it is estimated will produce over 500 gallons per day. This well was not connected to the supply at the time of the inspection. The wells pass through 5 feet of loam, 51 feet of sand and gravel, and 3 feet of hardpan into a water bearing gravel.

A privy not provided with a vault and in an insanitary condition exists about 25 feet east of the wells, and another privy in similar condition exists about 150 feet south of the wells. Some 200 feet east of the wells a small stream passes through the village and discharges into the harbor. This stream, which formerly received considerable sewage from a large portion of the village, has been practically freed from this pollution since the beginning of 1920, when the sewage disposal plant was completed and put in operation.

As a result of the reinspection of the supply, it was concluded that the recommendations of our previous report have in part been carried out; that the water supply from the old wells was of a satisfactory sanitary quality at the time of the inspection, but that there remain certain possibilities for serious and dangerous contamination of the public supply in view of the fact that numerous privies of unsatisfactory construction exist within a short distance of the wells.

It was accordingly recommended that wherever possible the privies and cesspools within 500 feet of the wells be abandoned, the cesspools and vaults cleaned, disinfected, and refilled with fresh earth, and the houses served provided with inside fixtures connected to the sewerage system, and that when it is impossible to connect a house or building to the sewer system and abandon the privy or cesspool serving such house or building, the privy be provided with watertight removable container, and the cesspool made watertight, and that such privies or cesspools be cleaned at frequent intervals, the contents disposed of in a satisfactory manner in some remote place and maintained in proper sanitary condition. It was also recommended that a careful sanitary patrol be maintained over the area within the vicinity of the wells at all times.

PORT JERVIS

A reinspection of the public water supply of the city of Port Jervis was made by Mr. W. J. Erickson on May 14, 1920, previous inspections of the supply having been made in 1908, 1909, and 1915.

Port Jervis is a city of about 10,300 inhabitants located on the Delaware river, in the western part of Orange county. About 90 per cent of the total population is furnished with water from the public supply, which is owned and operated by the Port Jervis Water Company.

The supply is derived from several small streams north of the city and collected in three impounding reservoirs, from which it is delivered to the consumers by gravity. An auxiliary supply is obtained by pumping from the Neversink river. The water consumption is about 300,000 gallons per day.

The watershed of the main supply covers an area of about 5½ square miles, most of which is hilly and wooded. Approximately 1,800 acres of this area is owned by the Water company. Except the two dwellings of the caretakers, there are no houses on the land draining to the reservoirs. The only possible source of pollution noticed at the time of the inspection was a road skirting reservoir No. 1.

The watershed of the Neversink river, from which the auxiliary supply is obtained, has an area of about 350 square miles, and receives considerable pollution from the villages and hamlets located along it. The water from this source whenever used is sterilized with liquid chlorine.

As a result of the inspection it was concluded that the water supply derived from the upland stream was of a satisfactory sanitary and physical quality, but that the auxiliary supply from Neversink river was not suitable for human consumption without treatment.

It was therefore recommended that the Water company continue their careful oversight of the water supply, and that whenever the water from Neversink river is used it be effectively sterilized with liquid chlorine.

The water of this supply is used by the Erie and the New York Ontario and Western Railroads for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on October 23, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the main supply were satisfactory, and that the results of the inspection and analyses of the samples, together with the results of previous inspections and analyses, indicate that the water of the main supply was of satisfactory quality for human consumption. The conditions surrounding the auxilary supply were not satisfactory, and the water derived therefrom cannot be considered satisfactory without efficient chlorination. A copy of the report accompanied this data. Based on this information the United States Public Health Service on November 24, 1920, issued a certificate permitting the use of this supply for drinking and culinary purposes in interestate traffic.

PORT WASHINGTON

A reinspection of the public water supply of the unincorporated village of Port Washington, Nassau county, was made by Mr. Alfred Mullikin, assistant engineer in this Department, on June 11, 1920, a previous inspection having been made by this Division in 1916.

Port Washington is located in the northern part of the town of North Hempstead, abount 20 miles from Mineola. The total population in winter is about 5,000, but increases to about 12,000 in the summer. Of the total population, 80 per cent are served with water from the public supply, which is owned by the Nassau County Water Company.

The water supply is derived from 3 8-inch driven wells 75 feet deep, 3 8-inch driven wells 190 feet deep, and 1 12-inch driven well 55 feet deep. The wells are located in a low piece of wooded marsh land covering about 4 acres in the north central part of the village, approximately one-half mile northwest of the Long Island Railroad depot. The wells are subject to possible indirect pollution by surface wash from the road, and some 8 or 10 houses at a higher elevation than the wells within a distance of about 500 feet. Most of these houses are provided with earth vault privies, although some are equipped with patent metal containers, which it is said are regularly disinfected.

As a result of the reinspection it was concluded that the authorities in charge of the water supply have in part carried out the previous recommendations of this Department but that there remain certain opportunities for possible contamination of the supply; that the bacterial analyses show active contamination of the water; and that the water cannot be regarded as one of entirely satisfactory sanitary quality.

It was therefore recommended that all the houses in the vicinity of the wells be connected with the sewerage system or provided with privies having watertight containers; that the Water company take all possible precaution to prevent pollution of the soil in the vicinity of the wells; and that if the elimination of all possible sources of pollution in the vicinity fails to prevent contamination of the water, it be sterilized by the continuous application of liquid chlorine, or a new source of supply be developed.

POUGHKEEPSIE

A reinspection of the public water supply of the city of Poughkeepsie was made by Mr. A. I. Howd, assistant engineer in this Department, on October 28, 1920, previous inspections of the supply having been made by this Division in 1907, 1915, and 1916.

The city of Poughkeepsie has a population of about 35,000, and is located in the west-central part of Dutchess county, on the east bank of the Hudson river. The waterworks are owned and operated by the city under the direction of a board of public works.

The water supply is obtained from the Hudson river, the intake being located about a mile north of the center of the city. The water is pumped from the river through a filtration plant from which it flows, after treatment, back to the pumping station. It is then pumped to a 13,000,000-gallon open reservoir on College Hill Park, from which it is delivered by gravity to the city. The daily consumption averages about 2,900,000 gallons, or 87 gallons per capita.

The raw water flows from the Hudson river through a 24-inch castiron intake pipe to two suction wells, where coagulant is applied to it in the form of powdered alum by a dry-feed machine at rates varying from 8.9 to 2.5 grains per gallon. From the suction well the water is lifted to the sedimentation basin, liquid chlorine being applied to it at the rate of about 0.48 parts per million just before it enters the basin. This basin is baffled and provides a detention period of approximately 18 hours. From the sedimentation basin the water flows to four preliminary rapid sand filters, through which it passes at the average rate of about 105,000,000 gallons per acre per day. From these preliminary filters the water flows by gravity to the slow sand filters, which consist of four beds about 4 feet deep, each having an area of one-third of an acre. When all the units are in operation the rate of filtration is approximately 3,000,000 gallons per acre per day. The effluent from the slow sand filters discharges into a clear water basin having a capacity of about one-quarter of a million gallons. As it leaves this basin the water is treated with liquid chlorine at the rate of about 0.45 of a part per million, and flows to the pumping station, from which it is pumped to the College Hill Park reservoir.

Samples of raw and filtered water were taken at the time of the inspection, and an examination of the results of the analyses of these samples indicates that while the raw water showed high bacterial counts and the presence of B. coli in all of the inoculations tested, the filtered water showed a low count and entire absence of bacteria of the colon type.

As a result of the inspection it was recommended that the authorities in charge of the water supply continue the careful and effective operation of the filter plant at all times.

The water of this supply is used by the New York Central and the Central New England Railroads for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on December 17, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were satisfactory, and that the results of the inspection and analyses of the samples, together with the results of previous inspections and analyses, indicate that the water was of satisfactory quality for human consumption. A copy of the report accompanied this data.

POUGHKEEPSIE (Hudson River State Hospital)

Amended plans for proposed additions and alterations to the water supply system of the Hudson River State Hospital at Poughkeepsie, N. Y., consisting of State Architect's drawing No. 2030, were submitted to this Department for approval by the State Architect on March 20, 1920. The amendment to the original plans approved by this Department on January 17, 1918, consisted only of slight changes in the structural details. After careful consideration by the Engineering Division, the plans were approved on March 20, 1920.

PRATTSBURG

A reinspection of the public water supply of the village of Prattsburg was made by Mr. Earl Devendorf, assistant engineer in this Department, on October 30, 1919, previous inspections of this supply having been made in 1910 and 1914.

Prattsburg is an incorporated village of about 800 inhabitants located in the northeastern part of Steuben county. The water supply of the village is derived from an impounding reservoir of about 700,000 gallons capacity on

East Center creek, supplemented by several springs, and a 6-inch drilled well about 150 feet deep from which water can be pumped directly into the distribution system.

The conditions existing on the watershed of East Center creek were found to be the same as described in former reports, there being some 4 farm houses on the shed, from which the stream undoubtedly receives some indirect pollution at times of heavy rainfall. In one case the stream passes very close to the barns of one of the houses, and there are numerous pastures where cattle have access to the stream. There are seven springs the water from which flows to the reservoir. Most of these are fairly satisfactorily located and protected from contamination, but several of them are not properly protected and are subject to pollution by surface wash. The well is used only as an auxiliary source of supply during such times as the supply from East Center creek and the springs is not sufficient for the needs of the village.

As a result of the investigation it was concluded that the physical and sanitary quality of the present supply is at times of rainfall greatly affected by surface wash, and that the sanitary quality of the spring flow is also liable to be seriously affected at such times.

It was therefore recommended that the village authorities consider the matter of carrying out our former recommendations, and that they employ a competent engineer to make a daily study of the sanitary quality and available quantity of water obtained from the present sources, and of additional sources of supply in order that a satisfactory and economical plant may be developed for augmenting and protecting the present supply, or for developing a new supply adequate in quantity and of satisfactory sanitary quality.

PROMISED LAND

An inspection of the sanitary quality of the water supplies of the fish oil factories at Promised Land, town of Easthampton, Suffolk county, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on June 4, 1920.

The water supply of the factories, which is used by about 800 employees, is derived from two dug and two driven wells. The two dug wells and one of the driven wells serve the plant of the Fisheries Products Company, and the other driven well serves what is known as the Triton plant. The dug wells are only a few feet in depth and walled up with open brick work. The water is obtained from them by means of buckets. Neither is protected from surface wash or incidental contamination. One of the driven wells, owned by the Fisheries Products Company, is provided with a 1½-inch Gould hand-pump but not adequately protected from surface wash nor from the return of water pumped from the well. The other driven well, owned by the Triton Company, is protected by a tightly locked shed over which the windmill and a 10,000 gallon tank have been erected. The water is pumped to the tank and flows to the factory through a 2-inch galvanized iron pipe.

As a result of the inspection it was concluded that the two open wells and the driven well provided with a hand pump were not satisfactory as a source of water supply for human consumption, but that the driven well connected with the windmill was apparently yielding a water of satisfactory sanitary quality.

It was therefore recommended that the two dug wells be equipped with pumps and provided with concrete platforms to protect them from surface wash and the waste from the pumps; that the driven well provided with a hand pump be similarly protected; and that the companies in charge of the well consider the development of a new source of supply of unquestioned purity.

QUEENS COUNTY WATER COMPANY

An inspection of the public water supply furnished by the Queens County Water Company to the incorporated villages of Lynbrook, East Rockaway, Woodsburgh, Cedarhurst, and Lawrence; and the unincorporated villages of Valley Stream, Inwood, Oceanside, and Woodmere, in Nassau county; in addition to certain sections of New York city on the Rockaway peninsula in the Borough of Queens, consisting of Far Rockaway, Edgemere, Arverne, Rockaway Park, Bell Harbor, and Neponsit, was made by Mr. Alfred Mullikin, assistant engineer in this Department, on May 21 and June 17, 1920.

The water supply is derived from driven wells at Valley Stream, located south of Harlem road and west of the old Mill road, about one mile southwest of the Valley Stream railway station; and from driven wells at Rockaway park, located on the northern side of Washington avenue opposite Eastern avenue and south of the Long Island railroad tracks. There are two small standpipes, one located at Far Rockaway and one located at Rockaway park, having a combined capacity of 576,500 gallons. These standpipes take the surplus water and act as equalizing reservoirs. The average daily water consumption for the two plants for the year 1919 was 3,900,000 gallons, about 90 per cent of which was from the Valley Stream plant.

The driven wells at Valley stream, the main source of supply, consist of 75 shallow wells ranging in depth from 22 to 32 feet, and 52 deep wells ranging in depth from 143 to 204 feet. The shallow wells are 5 inches in diameter, with the exception of one which is 10 inches in diameter. The deep wells are 6 inches in diameter. In addition to the wells at Valley stream, the company has four 6-inch driven wells located near the Long Island railroad about one mile west of the Lynbrook station, and one shallow well 30 feet deep.

The driven wells at Rockaway park, the auxiliary pumping station which is used during the peak-load pumpage in the summer months of June, July, and August, consist of one 6-inch well 780 feet deep, two 8-inch wells 840 feet deep, and one new 10-inch well 900 feet deep. This last well has 80 feet of 8-inch strainer, and passes through 200 feet of clay and sand and 200 feet of sand and gravel.

On account of the considerable iron content, the water of both pumping plants is filtered. At Valley Stream the water passes through two fountain aerators, and from the aerators flows to two of the three slow sand filters and then to the collecting chambers. The filters have a total area of about 63,000 square feet and with two in use operate at a rate of about 3,500,000 gallons per acre per day. At Rockaway park the water is treated in a similar manner. The filters have a total area of 720 square feet and operate at a rate of about 21 million gallons per acre per day.

There are no houses in the vicinity of the Valley Stream pumping station, and there are apparently no opportunities for the pollution of the water supply. The area of land owned by the company in Nassau county is 285.22 acres. At Rockaway Beach, in the Borough of Queens, the pumping plant is located in a well populated section of Rockaway Park. It occupies practically one city block, covering an area of land measuring about 122 by 188 feet, supplemented by a small strip measuring about 40 feet by 100 feet which is located about 200 feet west of the plant. There is a possibility in this locality of indirect pollution from the private sewers which lead to the bay and from nearby laterals forming a part of the Rockaway Park sewerage system which has an outlet at the 116th street dock.

As a result of the reinspection of the public water supply furnished by the Queens County Water Company, it was found that the public water supply delivered by the Valley Stream pumping station is of a satisfactory physical and saintary quality, but that the water supply delivered by the Rockaway Park wells, which are located in a thickly settled portion of the village and subject to possible pollution by leakage from the sewers and the pollution of the soil in the vicinity, was not of entirely satisfactory quality, and contained some active contamination as shown by the analyses at the time of the inspection.

It was therefore recommended that the authorities in charge of the water supply continue the careful operation of the plant at Valley Stream and supervision of the watershed area, and that at the Rockaway Park plant steps be immediately taken by the authorities to eliminate the sources of pollution if possible, or effectively to purify the water by filtration or by sterilization with liquid chlorine.

QUOGUE

A reinspection of the public water supply furnished by the Quantuck Water Works Company to the villages of Quogue, East Quogue, Westhampton Beach, and Quiogue, of Suffolk county, N. Y., was made on June 2, 1920, by Mr. Alfred Mullikin, assistant engineer in this Department, a previous inspection of this supply having been made by this Division in 1915.

Quogue is located in the southwestern part of the town of Southampton, about 75 miles from New York city. The population of the various villages varies considerably from winter to summer. The total winter population, amounting to 2,350, is increased to 6,000 during the summer months.

The water supply is derived from 16 driven wells, four of which are artesian, located near Quantuck creek, about 1½ miles southwest of Quogue station.

The wells are each 8 inches in diameter and 60 feet deep. The strata through which the wells pass consist entirely of sand. The wells reach what is called a third water level. Four of the wells are artesian, and their casings terminate in brick and cement vaults or manholes 8 feet in diameter and 30 feet deep. These vaults act as collecting chambers, into each of which a 6-inch suction main extends. The vaults extend a foot or more above the ground surface and are covered with circular castiron covers. The ground water level is approximately 4 feet below the surface.

The water company owns or controls about 200 acres of land surrounding the plant. There were apparently no direct sources of pollution at the time of the inspection, the nearest house being about 400 feet southeast of the plant, which is occupied by the man in charge of the pumping station. This house is provided with a toilet which connects to two cemented cesspools, one overflowing into the other. These are each 15 feet in diameter and 15 feet deep, and are cleaned once a year. There is no toilet at the pumping station, the employees using the toilet in the engineer's house. Since the use of a toilet at so great a distance from the station is undoubtedly inconvenient, and may, if new and less careful men are employed, lead to the pollution of the ground near the wells, it would seem desirable that the company consider the installation of a suitable toilet in the station connected by a tight castiron pipe to a cesspool located as far as possible from the wells. Until such a toilet and its appurtenances are installed, the rules against pollution of the ground near the station should be strictly enforced. The houses in the village are provided with either privies or cesspools as there is no sewerage system.

As a result of the reinspection it was found that the water supply at the time of the inspection was of satisfactory physical and sanitary quality; and it was accordingly recommended that the Water company continue to maintain the supply in a satisfactory sanitary condition, and frequently inspect the area in the vicinity of the wells to discover any possible source of pollution and immediately eliminate such possible sources when discovered.

RED HOOK

A reinspection of the public water supply of the village of Red Hook, Dutchess county, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on April 26, 1920, previous inspections of this supply having been made by this Division in 1911 and 1919.

Red Hook is a village with a population of approximately 900, located in the northwestern part of Dutchess county, about 3 miles east of Tarrytown. Of the total population, about 80 per cent are served with the public water supply.

The waterworks are owned and operated by the village under the direction of a board of trustees. The supply is derived from 2 dug wells about one-half mile east of the village, from which the water is pumped to a concrete-lined open reservoir on a hill southeast of the pumping station. The average daily consumption is about 45,000 gallons, or 83 gallons per capita.

As a result of the reinspection it was concluded that the authorities in charge of the water supply have only in part carried out the previous recommendations of this Department, and that there remain opportunities for serious contamination of the supply.

It was therefore recommended that the municipal authorities in charge of the water supply carry out at once such of our previous recommendations as have not yet been acted upon; that the manure pile at the south side of the wells be removed; that the reservoir walls be raised or a ditch be dug around the reservoir to prevent surface wash from entering the supply; that the wells be properly screened or otherwise protected to prevent the entrance of small animals; and that the tile casing around the suction main at the wells be repaired.

RENSSELAER

A reinspection of the public water supply of the city of Rensselaer was made on May 12, 1920, by Mr. W. J. Erickson, sanitary inspector in this Department.

Rensselaer, a city of about 13,000 inhabitants, is located on the east bank of the Hudson river directly opposite Albany. The waterworks are owned and operated by the Rensselaer Water Company. Practically all of the city is served by a public sewer system which discharges its sewage into the Hudson river without treatment.

The water supply is derived from the Hudson river. The intake is located opposite the pumping station on the northern edge of the city. After preliminary sterilization and coagulation it is passed through gravity mechanical filters and then again sterilized and pumped into the distribution system, the surplus going to a 6,000,000 gallon reservoir. The average daily consumption is about 1,500,000.

The water is pumped into the coagulation basins which have a total capacity of about 120,000 gallons and give a detention period of about an hour. Alum is fed to the suction of the pump which discharges it into the basin at the rate of 1.5 grains per gallon in summer and of about 2 grains per gallon in winter. The filters are 8 in number, of the original Continental-Jewel type, and are all 15 feet in diameter. The filtering medium consists of about 4 feet of sand underlain with about 6 inches of gravel. The average rate of filtration is about 425,000 gallons per unit per day, or about 105,000,000 gallons per acre per day.

The two apparatuses for applying liquid chlorine are both of the Electro Bleaching Gas Company type. At the time of the inspection the chlorine was being applied at the point of preliminary chlorination at the rate of about 0.4 parts per million, and at about 0.7 parts per million for the final chlorination.

The results of the analysis of samples of the filtered water show that the filters were efficient in oxydizing the organic matter and in the removal of bacteria, B. coli being absent in the sample of filtered water tested.

As a result of the reinspection it was concluded that the public water supply of Rensselaer, though derived from a grossly polluted source, was at the time of the inspection very efficiently purified by filtration and chlorination, and it was therefore recommended that the Water company continue the careful supervision and operation of the plant.

RHINEBECK

A reinspection of the public water supply of the village of Rhinebeck, Dutchess county, N. Y., was made by Mr. N. H. Baier, sanitary inspector in this Department, on October 25, 1920, a previous inspection of the supply having been made by this Division in the year 1912.

Rhinebeck is located in the west-central part of the town of Rhinebeck, 54 miles south of Albany. The present population is 1,600, of which 75 per cent is served by the public water supply. The unincorporated village of Rhinecliff is also served with water from this supply. The waterworks are owned and operated by the Rhinebeck Water Company.

The water is derived from two 8-inch driven wells, 300 feet deep in broken rock, about a mile east of the village of Rhinebeck, near the east side of Landsman kill. It is carried by an air lift pump to a basin and delivered by pumping through a distributing system consisting of some 11 miles of wrought-iron pipe. A reservoir is 75 feet square and 10 feet 4 inches deep, having a capacity of 435,000 gallons, takes the surplus and acts as an equalizing reservoir. The average domestic consumption of the municipalities is 90,000 to 100,000 gallons per day, or about 75 gallons per capita.

As a result of the reinspection of the public water supply of Rhinebeck it was concluded that the authorities in charge of the water supply have in part carried out the previous recommendations of this Department; that the water supply of the well known as well No. 2 was at the time of the inspection apparently of a satisfactory sanitary quality; and that the water of the well known as well No. 1 is apparently receiving pollution either by the seepage of the water from the creek, particularly at times of high water, through the upper layers of porous soil into the wells, the seepage of polluting matter from privies, leaching cesspools, and pasture land in the vicinity of the wells through the porous soil into the water supply, or the entrance of polluting matter into the water supply through the annular space between the eduction pipe and casing.

It was recommended that all privies within 500 feet of the well be provided with removable water-tight containers; that all cesspools within 500 feet of the wells be made water-tight, and the contents of the cesspools and containers be disposed of at some remote place in a suitable manner; that the well casings be carefully sealed to prevent the entrance of foreign material; and that if after all probable sources of pollution of well No. 1 are removed, the water supply is still found to be of an unsatisfactory sanitary quality, a new source of supply be obtained.

RICHMONDVILLE

A reinspection of the public water supply of the village of Richmondville was made by Mr. W. J. Erickson, sanitary inspector in this Department, on October 14, 1920, previous inspections having been made by this Division in 1912 and 1914.

Richmondville is an incorporated village of 600 inhabitants located in the west central part of Schoharie county, about 50 miles west of Albany. Practically the entire population is served with the public water supply which is owned by the village and is under the direction of the board of water commissioners. There is no public sewer system in the village.

The supply is derived from the headwaters of Cobleskill river by impounding them in a storage reservoir located about 3 miles west of the village. From this reservoir the supply flows by gravity to the consumers. The reservoir has an area of about 1½ acres and is 7 or 8 feet deep. It is surrounded with a wire fence which encloses an area of about 3 acres. There is, however, a cattle path between the fence and the steep slope rising to the state road above. The area surrounding it is used for pasture. Considerable difficulty has been experienced from bad tastes and odors resulting from the decomposition of algae growths and from turbidity at times of heavy runoff. The watershed tributary to the reservoir is about 1¾ square miles in area, most of which is on the uninhabited slopes of the surrounding hills. There are, however, about 6 houses with a total population of about 16 or about 9 per square mile. The main highway and the Delaware and Hudson railroad pass through the watershed parallel to the stream. A less used highway crosses the upper end of it.

As a result of the reinspection it was concluded that the physical quality of the water supply of Richmondville is depreciated by the high turbidity and disagreeable tastes, and that the purity of the supply is menaced by a farmyard through which the stream passes, and also by a privy near the stream, and other sources of pollution incidental to an inhabited watershed.

It was therefore recommended that drainage ditches be constructed so as to divert surface wash from the reservoir, and a by-pass arranged to divert the muddy water at times of heavy rainfall; that the cattle path be re-located at such a distance that the drainage from it will not enter the reservoir; that the water be treated with copper sulphate to prevent the growth of algae; that the water mains be regularly and thoroughly cleaned in order to prevent the accumulation of sediment in them; that all privies be removed to a distance of 100 feet from any watercourse tributary to the reservoir, so that no drainage may reach the supply either directly or indirectly; that in order to prevent any contamination of the supply at the Patrick farm, the stream be carried past the barnyard by means of tile pipe so laid that no surface wash may enter it; that regular inspections be made of the watershed in order to detect and abate any insanitary conditions found thereon; and that should any difficulty be experienced in carrying out the above recommendations, the village authorities apply to this Department for the enactment of rules and regulations for the protection of the supply from contamination.

RIVERHEAD

A reinspection of the public water supply of the village of Riverhead, Suffolk county, N. Y., was made on May 27, 1920, by Mr. Alfred Mullikin, assistant engineer in this Department, a previous inspection of this supply having been made by this Division in 1915.

Riverhead is located at the head of Great Peconic bay, about 75 miles from New York city. The present population is estimated at 6,450. Of this total population 60 per cent are served with the public water supply and 40 per cent by private wells. The public supply is owned and operated by the Riverhead Water District.

The water supply is derived from five driven wells located in the eastern section of the village about one-half mile east of the railroad station and less than 100 feet north of the Long Island railroad tracks. The water is drawn from the wells by a low lift pump and delivered to an aerator, from which it flows by gravity into a concrete settling reservoir. From this reservoir it is pumped through pressure mechanical filters into a distributing system.

The wells consist of two 8-inch shallow wells driven through sand to a depth of 48 feet, and three 8-inch artesian wells driven to a depth of 88 feet. The deep wells pass through 45 feet of sand, 10 feet of clay, and 33 feet of sand. The shallow wells are said to be provided with 10-foot strainers extending from 17 feet to 27 feet below the surface, and the deep wells with 20-foot strainers extending from 55 to 75 feet below the surface.

The two pressure mechanical filters are of the horizontal type each 8 feet in diameter and 20 feet long. The depth of sand as shown on the plans of the filters is 3½ feet. The rate of filtration, with one filter in operation, figured on the area at the diameter of the cylinder is 160,000,000 gallons per acre per day. With both in operation the rates are of course one-half those just given. No coagulant is used. The filters are washed once a week.

At the time of the inspection samples of water from the public water supply were collected and sent to the Division of Laboratories and Research for examination. The results of the analyses of these samples, together with the results of analyses of samples taken in 1916, will be found in the appended table.

The results of the analysis of the filtered water show a water clear, colorless, and very soft. The figures for nitrogen in its various forms and for oxygen consumed are moderately low, and indicate the presence of small amounts only of decomposing and decomposable organic matter. The amount of iron in the water is relatively small and should not be an objectionable feature. The total bacterial count for the filtered water is low, and the absence of organisms of the colon group indicate that the water is free from active contamination. Samples of water for bacterial analysis only were taken from the raw water and from the settling reservoir. The bacterial count of the raw water is somewhat high but shows a marked decrease for the water after aeration and sedimentation. The absence of organisms of the B. coli type in both these samples indicates the freedom of the supply from active and dangerous contamination.

As a result of the reinspection of the public water supply of Riverhead it was concluded that the authorities in charge of the water supply have not carried out the previous recommendations of this Department, and that there remain certain opportunities for serious contamination of this supply from the numerous privies located within a relatively short distance of the well supply.

It was therefore recommended that the town authorities have all privies within 500 feet of the wells provided with water-tight removable containers, and all cesspools made water-tight; that they require that the privies and cesspools be maintained in a satisfactory condition, and the contents properly removed and disposed of when necessary; that a careful sanitary patrol be maintained at all times over the area within 500 feet of the wells; and that the town authorities consider the construction of a properly designed sewer system to take care of the sewage from the houses in the immediate vicinity of the wells.

ROCKVILLE CENTER

A reinspection of the public water supply of the village of Rockville Center was made on May 18, 1920, by Mr. Alfred Mullikin, assistant engineer in this Department, a previous inspection of the supply having been made by this Division in 1915.

The village of Rockville Center is located in the southwestern part of Nassau county, about 21 miles from New York city. The population of the village is estimated at about 7,000, practically all of whom are served with water from the public supply. The waterworks are owned and operated by the municipality under the direction of the board of trustees.

The water supply is derived from five driven wells located in the eastern section of the village. From the wells the water is pumped into a distribution system consisting of 28 miles of castiron pipe, the surplus going to a steel standpipe 20 feet in diameter and 100 feet high, having a capacity of about 235,000 gallons, which acts as an equalizing reservoir. The average daily water consumption is practically 254,500 gallons, or 36 gallons per capita.

As a result of the reinspection it was concluded that the authorities in charge of the water supply have in part carried out the previous recommendations of this Department, and that there remain certain opportunities for serious contamination of the water supply which may at any time reach the consumers should the chlorine apparatus fail to operate properly.

It was therefore recommended that the pollution of the ground in the vicinity of the wells be prevented as far as possible by providing water-tight containers for all privies near the wells, making all cesspools near them water-tight, and maintaining the privies and cesspools in a sanitary condition; that the village take steps toward the installation of a sewerage system and the abandonment of all privies and cesspools; that the chlorinating apparatus be operated continuously, and such quantities of chlorine applied to the water as will effectively sterilize the water; and that the treated water be frequently tested by the operator of the plant for excess chlorine in accordance with the instructions of this Department, in order that the necessary quantity of chlorine to be applied may be known.

ROOSEVELT

A reinspection of the public water supply of the village of Roosevelt, Nassau county, N. Y., was made on May 19, 1920, by Mr. Alfred Mullikin, assistant engineer in this Department, a previous inspection of this supply having been made by this Division in 1915.

Roosevelt is located in the town of Hempstead, about two or three miles north of the village of Freeport, and about 27 miles from New York city. The present population is estimated at 3,500. Of the total population, about 50 per cent are served with water from the public supply. The waterworks are owned and operated by the Roosevelt Water, Power and Light Company.

The water supply is derived from a tile well in the northwest corner of the development, and is pumped into two steel water and air pressure tanks from which it is forced into the distribution mains consisting of about 10 miles of castiron pipe ranging from 4 to 10 inches in diameter. The well is 18 inches in diameter and 56 feet deep, and is provided with an 18-inch tile casing and protected at the top by an iron manhole cover which is locked at all times. The water rises in the well to within 17½ feet of the surface of the ground.

From the recent inspection it appears that the recommendations have been only partly carried out; that the privy and cesspool have not been removed, but that a metal container has been provided for the privy, and the contents disposed of at a remote place at proper intervals; that the cistern receives only the water drainage from the leakage of the pumps and is not used for the disposal of sewage; that analyses of water have not been regularly made by the water company; and that the pumping plant is maintained in an untidy condition.

At the time of the inspection samples of water from the public water supply were collected and sent to the Division of Laboratories and Research for examination. The results of the analyses show a water clear, colorless, and fairly soft. The figures for the ammonias are low, indicating the presence of only very small amounts of decomposing and decomposable organic matter. The figures for nitrites, nitrates, and chlorine are rather high, indicating that pollution has reached the supply but has been oxydized and rendered inactive by natural processes of purification during its passage through the soil. Although the total bacterial count is very high for a well water, the absence of bacteria of the colon group indicates that the water supply was, at the time the samples were taken, free from active and dangerous contamination.

As a result of the reinspection it was concluded that the authorities in charge of the public water supply have in part carried out the previous recommendations of this Department but that the plant is not maintained in a neat condition.

It was therefore recommended that the grounds and engine room be kept in a neat and orderly condition, and that the authorities in charge of the water supply maintain a careful sanitary patrol in the immediate vicinity of the pumping plant to prevent any conditions occurring that might deleteriously affect the water supply.

ROSCOE

A reinspection of the public water supply of the village of Roscoe was made on October 28, 1920, by Mr. W. J. Erickson, sanitary inspector in this Department, a previous inspection having been made in 1918.

Roscoe is an unincorporated village situated in the northern part of Sullivan county, about 57 miles west of Middletown, on the New York, Ontario and Western railroad. The public water supply is owned by the Roscoe Water Company.

The supply is derived from a small stream known as Wood brook, a tributary to Beaver kill. The water is impounded in a storage reservoir of about 60,000 gallons capacity, located about 3 miles south of the village. From this reservoir the supply flows by gravity after passing through a crude charcoal filter to the distribution system.

The watershed tributary to the reservoir is about 3 square miles in area and is rather hilly. There is some cultivation and grazing carried on on the watershed. The permanent population is about 35, or about 12 per square mile. During the summer months, due to the influx of summer boarders, the population is increased to about 125, or to 41 per square mile. The cesspool mentioned in the previous report has been put into a better shape than at the time of the previous inspection. A subsurface tile drain has been constructed to take care of the overflow from the cesspool and appeared to be operating efficiently at the time of the inspection. The cesspools of the other boarding houses are located at a considerable distance from the stream and were operating in a satisfactory manner at the time of the inspection. The road passes near the stream and crosses it at four places so that considerable road wash reaches the supply. It does not seem probable that all this wash can be diverted from the stream by drainage ditches. Besides this road wash, the supply is subject to contamination from the comparatively densely populated watershed especially during the summer months.

Samples were collected at the time of the inspection and sent to the Division of Laboratories and Research for analysis, the results of which are as follows:

Color	35	Oxygen consumed	7.5
Odor, hot	None	Chlorine	2.4
Odor, cold	None	Hardness, total	18.2
Turbidity	Trace	Alkalinity	10.0
Ammonia, fr.	.002	Bacteria per c. c. 20°C.	18,000
Ammonia, alb.	.076	Bacteria per c. c. 37°C.	2,000
Nitrites	.008	B. coli type:	
Nitrates	.200	10 c. c.	3+0—
		1 c. c.	3+0—
		1/10 c. c.	1+2—

These analyses show a water that is soft, practically clear but at times considerably colored. The figure for nitrogen compounds in its various forms and that for oxygen consumed indicated the presence of considerable organic matter. The figure for chlorine is higher than normal for surface water of this origin. The total bacterial counts are high, and the presence of intestinal organisms in as small an inoculation as 1/10 c. c. indicates considerable active contamination.

As a result of the reinspection it was recommended that the water company immediately install and put in operation suitable apparatus for the sterilization of the supply by liquid chlorine; that in order to protect the supply from contamination the intake be extended up the stream to such a point as to be above the principal sources of contamination, or a modern filtration plant be installed; that the water company apply to this Department for the enactment of rules and regulations for the protection of the sanitary quality of the water supply, and strictly enforce such rules and regulations when enacted; and that should the water company find difficulty in placing the watershed in a satisfactory sanitary condition, or producing a safe supply by proper treatment, they consider the development of a new and safe supply.

The water of this supply is used by the New York, Ontario and Western Railroad for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on December 2, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were not entirely satisfactory, and that the results of the inspection and analyses of the samples, together with the results of previous inspections and analyses, indicate that the water cannot be considered to be of entirely satisfactory quality for human consumption. A copy of the report accompanied this data.

ROSLYN WATER COMPANY

A reinspection of the public water supply furnished by the Roslyn Water Company to the unincorporated villages of Roslyn, Albertson Square, South Glenwood, and Old Westbury, in the town of North Hempstead; and Wheatley Hills and Brockville, in the town of Oyster Bay, Nassau county, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on June 14, 1920, a previous inspection of the supply having been made by this Division in 1915.

Roslyn is located in the northern part of the town of North Hempstead, at the head of Hempstead Harbor, about 24 miles from New York city. The present population is estimated at 3,500, of whom 80 per cent are served with water from the public water supply. The waterworks are owned and operated by the municipality under the direction of the board of water commissioners.

The water supply is derived from three driven wells located about a mile north of the railroad station on the West Shore Road, near the west bank of Hempstead Harbor. From the wells the water is delivered by pumping through a distributing system consisting of some 39 miles of castiron pipe. A steel standpipe 20 feet in diameter and 60 feet high, having a capacity of 142,000 gallons, takes the surplus and acts as an equalizing reservoir. The average daily water consumption in summer is approximately 300,000 gallons, or 106 gallons per capita; and in winter, approximately 175,000 gallons, or 62.5 gallons per capita. At the time of the inspection there were no apparent sources of pollution of the water supply, although there are numerous houses within 500 feet of the plant in a southwesterly direction. The village is provided with a domestic sewerage system, which takes care of about 50 per cent of the population. Some of the houses, however, are provided with disposal plants of the subsurface irrigation type, and about 20 per cent are provided with privies. The toilet at the pumping station is provided with a 6-inch tile pipe which empties into Hempstead Harbor after passing through a cesspool.

As a result of the reinspection of the public water supply of Roslyn it was concluded that the water supply was of a reasonably satisfactory sanitary quality but that there are certain possibilities of indirect pollution from the numerous houses in the vicinity of the wells.

It was therefore recommended that all sewers within a distance of 500 feet from the wells be of castiron pipe with lead joints; that all cesspools within 500 feet of the wells be made impervious; that all privies be provided with water-tight containers, and the contents disposed of in a remote place at proper intervals of time; and that the authorities in charge of the public water supply maintain a careful patrol over the area in the vicinity of the wells with a view to preventing any possible pollution of the soil by ground water.

ROUSES POINT

A reinspection of the public water supply of the village of Rouses Point was made on September 12, 1919, by Mr. W. J. Erickson, engineering assistant in this Department, previous inspections of this supply having been made by this Division in 1910, 1911, 1915, and 1918.

Rouses Point is an incorporated village located in the northeastern part of Clinton county, about one mile from the Canadian border. It has a population of about 1,500, practically all of which is served by the public water supply, which is in charge of a board of water commissioners. The supply is derived from Lake Champlain, the intake being 1,200 feet from the shore. The water is pumped directly into the mains after being treated with hypochlorite of lime. The consumption is about 500,000 gallons per day.

The chlorination apparatus was not, however, in operation at the time of the inspection and had not been in operation for several days, due to clogging of the feed pipe.

As a result of the reinspection it was recommended in the report on the inspection dated January 14, 1920, that the hypochlorite plant be abandoned, and duplicate liquid chlorine apparatus be substituted and properly operated at all times; and that pending the securing of such apparatus the present hypochlorite plant be operated efficiently at all times in accordance with our previous recommendations; and that the village consider the installation of some modern method of filtration supplemented by chlorination.

Information furnished to the Department after the report was made indicates that in accordance with our recommendations a liquid chlorine sterilizing plant was installed and put in operation in July, 1920.

SAG HARBOR

Reinspections of the public water supply of the village of Sag Harbor were made on January 8, 1920, and June 31, 1920, by Mr. Alfred Mullikin, assistant engineer in this Department, previous inspections of this supply having been made by this Division in 1909 and 1915.

Sag Harbor is an incorporated village of 5,300 inhabitants located in Suffolk county, at the head of Gardiner's bay, at the center of the eastern end of Long Island, 100 miles from New York city. The water supply is derived by pumping in part from Long pond, located about one mile southwest of the village, and in part from dug and driven wells about midway between the pond and the village. The waterworks are owned and operated by the Sag Harbor Water Company.

As a result of this investigation it was concluded that the present water supply of Sag Harbor is of a reasonably satisfactory quality from the standpoint of freedom from possible contamination, but is unsatisfactory from an aesthetic standpoint, due to odor, taste, and color; that in view of the trouble experienced in the past with the excess of iron in the ground water in this locality, the Sag Harbor Water Company has selected new sources of supply every few years, in unsuccessful attempts to secure a supply of satisfactory quality, which attempts have been made without competent engineering advice, and have consequently resulted in failure to secure returns for the considerable amount of money expended; and that the Sag Harbor Water Company has not carried out the recommendations for correcting the trouble as set forth in former reports by this Department.

It was accordingly recommended that the Water company employ a competent sanitary engineer to study the problem and to advise specifically as to the measures necessary to assure an adequate supply of satisfactory physical and sanitary quality; and that consideration again be given to using the four original wells, with provision for aeration followed by sedimentation and filtration for the removal of excess iron.

SALTAIRE

An inspection of the public water supply of the village of Saltaire, Suffolk county, N. Y., was made on June 17, 1920, by Mr. Alfred Mullikin, assistant engineer in this Department.

The village of Saltaire is located on Fire Island, about 6 miles south of Bayshore. The present population is estimated at 1,000, of whom about 70 per cent are served with the water from the public water supply. The waterworks are owned and operated by the Fire Island Beach Developing Company.

The water supply is derived from a driven well located about one-quarter of a mile southeast of the village dock. The water is pumped through a Roberts pressure filter into a steel tank which rests upon the sand, and is distributed through a network of pipe consisting of about 1½ miles of 2-inch galvanized iron pipe. The daily water consumption is approximately 21,600 gallons per day, or 31 gallons per capita. The supply is derived from a 6-inch flowing well some 400 feet deep driven through sand and clay. The Roberts pressure mechanical filter through which the water passes measures about 5 feet in diameter and 7½ in height, and is operated at the rate of about 192,000,000 gallons per acre per day. Alum is used as a coagulant. The water is filtered on account of fine clay in colloidal suspension.

The area reserved by the development company for the pumping plant consists of about one-half acre, the nearest houses being some 400 feet away. There seem to be no possibilities for direct pollution of the water supply. The area in the vicinity of the well, however, has not been fenced off to prevent trespassing.

As a result of the inspection it was concluded that the water supply was of a satisfactory sanitary quality at the time of the inspection; that there were, however, certain opportunities for contamination due to the possible pollution of the ground in the vicinity of the wells by trespassers; and that the well connected to the village pump, from which a part of the inhabitants obtain their water, is not satisfactorily protected in that the waste water is allowed to fall on the ground near the well.

It was therefore recommended that the authorities in charge of the water supply erect fences around the area in the vicinity of the well to prevent trespassing; that a tight concrete platform be constructed around the village pump and arrangements made to conduct the waste water to some distance from the well before allowing it to soak into the ground; and that the authorities maintain a careful supervision over the watershed area.

SARATOGA SPRINGS

A reinspection of the chlorination plant recently installed for the sterilization of the public water supply of the city of Saratoga Springs was made on December 5, 1919, by Mr. Earl Devendorf, assistant engineer in this Department, previous inspections of this supply having been made by this Division in 1911 and 1914.

The water supply of Saratoga Springs is derived from Loughberry lake, located in the northeastern section of the city. The supply is pumped, after chlorination, directly into the distribution system. The waterworks are owned by the city and operated under the direction of the department of public works.

The chlorination apparatus consists of a duplicate installation of the dry feed type manufactured by the Wallace & Tiernan Company. The gas is forced into the suction line of the pump by means of an injector operating on a water pressure of 80 pounds per square inch. The water consumption at the time of the inspection was estimated to be about 3,000,000 gallons daily. The chlorine was being applied at the rate of 9 pounds per 24 hours, or a rate of about .36 p.p.m. A test for excess chlorine on a sample of the treated water gave a distinct reaction by the starch iodide method. Daily records are kept of the pumpage and of the amount of chlorine applied as determined by scale weighings.

At times the water supply of Saratoga Springs is subject to objectionable tastes and odors due to algae growths in the reservoir. The supply is also open to accidental, incidental, or willful contamination by chance visitors to the lake and from permanent residents upon the watershed. It has been previously recommended by this Department that steps be taken to purify this supply, but until the installation of the chlorination plant in 1919 no action had been taken by the city authorities to carry out the recommendations. The installation of this chlorination plant is a step in the right direction, and if properly operated should protect the supply from all ordinary dangers of contamination. It should be pointed out, however, that the chlorination of the supply will not improve the physical quality of the water, particularly at times when troubles are experienced with tastes and odors therein. In order to secure a supply of satisfactory physical as well as sanitary quality, it is essential, as has been previously pointed out, for the village to install a modern filtration plant supplemented by aeration.

As a result of the reinspection it was recommended that the city authorities continue to operate the chlorination plant with care and efficiency at all times, and that consideration be given to the installation of a modern filtration plant supplemented by aeration in order to improve the physical quality of the supply.

The water of this supply is used by the Delaware and Hudson Railroad. Data regarding the supply were furnished to the United States Public Health Service on October 18, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were fairly satisfactory, and that the results of the inspection and the analyses of the samples, together with the results of previous inspections and analyses, indicate that the water is of satisfactory quality for human consumption, but that a filtration plant should be installed to improve the physical quality of the water. A copy of the report accompanied the data.

SARATOGA SPRINGS (Bottled Water)

An inspection of the sanitary quality of the waters bottled by the Saratoga Springs Water Corporation of Saratoga Springs, N. Y., was made by Mr. Henry Ryon, assistant engineer in this Department, on August 19, 1920.

The waters bottled by this corporation are the Ferndell water, the Geyser water, the Coesa water, and the Hawthorne No. 2 water. The Ferndell is a soft water from shallow wells in gravel, and the Geyser, Coesa, and Hawthorne No. 2 waters are all natural carbonated waters, high in mineral content, obtained from deep wells in rock.

The wells from which the Ferndell water is derived are located in a flat piece of land about 2 miles south of the city of Saratoga Springs. The wells are each 1¼ inches in diameter, fitted with 30-inch strainers, and are 33, 34, and 39 feet deep respectively. They are located between 40 and 60 feet southeast of the bottling plant, and connected to the plant by pipes laid beneath the surface of the ground. The soil in the vicinity is a fine sand containing some loam. There are, apparently, no permanent sources of pollution within ¼ of a mile of the wells. A public road passes about 150 feet east of the wells and there is a public comfort station located about 300 feet north of them. It was stated, however, that this comfort station has never been used. A toilet is provided in the bottling plant and drains to a swamp about one-third of a mile southeast of the wells. The connection from the toilet to the swamp is said to be of castiron pipe laid with lead joints. This pipe passes within about 35 feet of the nearest well.

The water used for washing the bottles at the plant is obtained from a small stream which passes the plant a short distance to the west. The watershed of this creek is comparatively free from permanent sources of pollution, but is, as was apparent at the time of the inspection, subject to accidental and willful contamination by trespassers.

The water is delivered to the purchaser in 5-gallon demijohns and 2-quart bottles. The empty 5-gallon demijohns when returned to the plant are taken first to a washing machine which consists of a revolving wheel having about 12 vertical jets on its periphery over which the demijohns may be inverted.

The wheel revolves in about two minutes. The temperature of the water at the point where the demijohns are placed over the jets is about 120°F. and gradually increases to 180°F. at a point diametrically opposite the place where the demijohns are placed on the wheel and then gradually decreases again to about 120°F. at the point where the demijohns are removed from the jets. No attempt is made to wash the outside of the demijohns. After the bottles have been thus rinsed and removed from the wheel containing the jets they are placed on a roller conveyor leading to the bottling taps, where they are filled. They are then passed along the conveyor for a distance of a few feet and corked and capped by hand. The corks before being placed in the bottles are sterilized in a low pressure autoclave capable of carrying about two or three pounds pressure. The corks are taken directly from this sterilizer and placed in the bottles.

The small 2-quart bottles when returned to the plant are treated in a similar manner to the large demijohns, except that the bottles are carried over a series of jets by a belt operating in a horizontal plane instead of being placed over jets on a wheel. The temperature of the water is said to be maintained at about 120°F. The small bottles are, however, before being refilled, placed in an autoclave and sterilized at a pressure of three or four pounds for a few minutes. They are lifted out of this autoclave and placed on a roller conveyor leading to the filling taps, where they are filled. They are then placed in the capping machine and capped. No attempt is made to sterilize the caps.

When new 2-quart bottles are received at the plant, however, they are passed through what is known as an alkali machine before being used. This machine consists of two vats, one containing a 4 per cent caustic solution and the other clear rinsing water. The liquid in both of these vats is said to be maintained at a temperature of about 120°F. The bottles are carried through the machine by an endless chain conveyor, passing first through the alkali solution and then through the rinsing water. After removal from the alkali machine the bottles are treated in the same manner as the bottles returned by the consumers.

No attempt is made to wash the outside of the bottles, although the arrangement of the washing machine is such that the jets of water play on the outside of the bottles while the inside is being rinsed.

The Geyser water is obtained from a well said to be about 300 feet deep, located under the bottling plant, about two miles south of Saratoga Springs on the road to Ballston Spa. The well casing is said to be 6 inches in diameter. The suction pipe is 1¼ inches in diameter and is said to extend to a point about 250 feet below the surface of the ground. The 6-inch casing is of course driven only to the rock. Under normal conditions the well flows. In order to supply the demands of the plant, however, it is necessary to pump, and for this purpose a small electrically driven deep well pump has been installed over the well and arranged to lift the water from it into a closed glass lined tank, from which it flows by gravity to the bottling machines.

The process of washing, filling, and capping the bottles is in general carried on by automatic machinery. In some cases, however, where the water has been heated in the bottles and they have consequently become coated on the inside with a deposit of calcium carbonate, they are first cleaned with hydrochloric acid. The bottles when received at the plant, with the exception of those thus treated, are placed first in the alkali machine where an endless chain conveyor carries them through the alkali vat containing a 4 per cent solution of alkali at a temperature of 120°F., then through the rinsing vat containing clear water at the same temperature, and from the rinsing vat on to a platform, from which they are taken and placed over vertical jets and revolving brushes which wash the interiors. From the washing machine they are passed to a gas machine, where each bottle is filled with carbon dioxide gas in order to prevent the deposition of iron salts which would occur if the carbonated mineral water were placed in bottles containing air. From the gas machine the bottles are carried by a conveyor to the filling machine, where they are filled with water, and then passed to the capping machine, where they are automatically capped. No sterilization of the bottles, other than the washing with the alkali solution and hot water, is attempted. The caps are not sterilized in any manner.

The Coesa water is obtained from a well located about ¼ of a mile south of the Geyser well. This well is said to be about 600 feet deep. The water is lifted from it by a pump similar to that used at the Geyser well and discharged through a pipe to the bottling plant, where it is bottled with the same machinery used for the bottling of the Geyser water.

The Hawthorne No. 2 water is obtained from a well about 400 feet deep located approximately ¼ of a mile south of the Coesa well. The water is handled in a similar manner to that from the Coesa well and bottled with the same machinery.

There is apparently no source of permanent pollution within a reasonable distance of any of these three wells. The toilets in the bottling plant under which the Geyser well is located are connected by a castiron pipe which discharges into Coesa creek, about 100 feet below the plant. The water for washing the bottles is obtained from an infiltration gallery on the north side of this creek at a point above this sewer outlet.

Samples of the water from all the wells were taken at the time of the inspection and sent to the Division of Laboratories and Research for examination. The results of the examination are as follows:

	Bacteria per cc count	B. coli in		
		10 cc	1 cc	1/10 cc
Ferndell water from bottling tap 5-gal. bottle Ferndell "A"	1	0+3—	0+3—	0+3—
Ferndell water from 5-gal. demijohn "B," bottled Aug. 19, 1920	2	0+3—	0+3—	0+3—
Geyser spring water bottling tap "C"	0	0+3—	0+3—	0+3—
Geyser spring "D," 3:30 P. M.	0	0+3—	0+3—	0+3—
Coesa spring "E"	2	0+3—	0+3—	0+3—
Hawthorne No. 2 spring water	250	0+3—	0+3—	0+3—
Hawthorne No. 2, rec'd in 1-qt. bottle sealed with tin cap marked "Hawthorne No. 2"	0	0+3—	0+3—	0+3—
Geyser water, 1-qt. bottle as it is sold, sealed with tin cap marked "Geyser"	26	0+3—	0+3—	0+3—
Coesa water, 1-qt. bottle as it is sold, sealed with tin cap marked "Coesa"	5	0+3—	0+3—	0+3—
Ferndell water, rec'd in 2-qt. bottle as it is sold, sealed with tin cap marked "Ferndell"	1	0+3—	0+3—	0+3—

It will be noted from an examination of the results of the analyses that the counts are in all cases very low, in most cases the water being practically sterile. In no case was the presence of bacteria of the colon type indicated in any of the inoculations tested. Since a complaint was received by this Department regarding the precipitate found in bottles of Geyser water as delivered to purchasers, an examination of this water to determine the cause of this precipitate was made. The report of Mr. L. M. Wachter, chemist of the Division of Laboratories and Research of this Department, on this matter, seems to indicate that the dark precipitate found in the bottles of Geyser water is due to the precipitation of iron and not to any fault in the washing of the bottles. This iron is always precipitated when the water from the Geyser well is exposed to the air, and it is probable that the cause of the precipitation of the iron in these bottles is due to the imperfect removal of the air from the bottles before they are filled. This removal, as explained above, is done while passing through the automatic bottling machines by filling the bottles with carbon dioxide, and the application of too small a quantity of carbon dioxide would undoubtedly leave some air in the bottles. The possibility that the precipitation of the iron might have been caused by the leakage of carbon dioxygen, with which the water is

impregnated, out of the bottles, cannot be entertained, because it was found that the water in which there was a considerable precipitate of iron was still fully charged with gas when the caps were removed.

SAUGERTIES

A reinspection of the public water supply of the village of Saugerties was made on October 14, 1920, by Mr. A. I. Howd, assistant engineer in this Department, previous inspections of this supply having been made by this Division in 1909 and 1915.

Saugerties is a village with a population of about 4,000, located in the northeastern part of Ulster county, about 42 miles south of Albany. Of the total population, practically all are served with the public water supply. The waterworks are owned and operated by the municipality under the direction of a board of water commissioners.

The public water supply is derived from an impounding reservoir on the Plattekill creek about 5 miles northwest of the village. From the reservoir the water is delivered by gravity through a distributing system consisting of about 18 miles of mains. The water consumption is about 320,000 gallons daily, or 80 gallons per capita.

The Plattekill creek above the point of intake of the public water supply has a watershed area of about 17 square miles. About 75 per cent of this area is wooded and the remainder is farming country. There are 89 houses on the watershed, 21 of which are unoccupied. The majority of the houses were a considerable distance from any stream.

As a result of the reinspection it was concluded that the authorities in charge of the water supply have taken commendable action in improving the sanitary condition of the watershed, but that in view of the relatively large population on the watershed the supply is subject to accidental or willful contamination.

It was therefore recommended that the village authorities install and operate an apparatus for the sterilization of the supply with liquid chlorine, and that they make regular, frequent, and thorough inspections of the watershed and continue their efforts in improving the sanitary condition of the watershed.

SCHENECTADY

In the spring of 1920 the Engineering Division of the New York State Department of Health was called upon to investigate an epidemic of gastroenteritis, followed by an outbreak of typhoid fever, in the city of Schenectady, N. Y., which occurred subsequently to the gross pollution of the public water supply of the city by the water of the Mohawk river. The results of the investigation, as outlined below, are interesting because of the clearly defined manner in which the effects follow the cause, and also because they illustrate how easily the trouble could have been avoided by the careful supervision of the waterworks, and how the effects might have been mitigated had the first warnings been heeded.

The matter was brought to the attention of the Division of Sanitary Engineering by the district sanitary supervisor, Dr. C. C. Duryee, on March 20, 1920, when information was received that on March 15 and a few days following the number of cases of gastroenteric disturbances in the city had greatly increased above the number normally occurring; and that this increase had followed a noticeable turbidity in the water, which had been greatest on the night of March 13 and during March 14, and had gradually disappeared after the latter date. Although the information was not received until several days after the incidence of the largest number of cases, Mr. Henry Ryon, assistant engineer in this Department, was at once sent to investigate the condition of the water supply to determine whether or not it had been, or was, such as would be likely to cause the disturbances reported, and Mr. Earl Devendorf, assistant engineer, was later detailed to assist him. On the date of the first inspection, March 20, 1920, the water was clear and colorless, and it was therefore necessary to depend largely on what could be learned from the officials and residents of the city for information regarding its alleged unsatisfactory condition. Most of the residents interviewed confirmed the statement above regarding the marked turbidity of the water and the gastroenteric disturbances which followed. The city officials stated that so far as they knew the turbidity was not very noticeable, and that it consisted of fine sand in the water, owing probably to the disturbed condition of the ground water flow caused by the recent thaws and the high water in the river. They also stated that the city chemist and the city bacteriologist had both recently examined the water and reported that it was perfectly safe for consumption without treatment. At the plant, little could be learned except that the water had risen very high in the wells on the 13th and 14th of the month. The man in charge of the plant stated that he had noticed a little turbidity in the water, but that he had not thought it of any importance, and could not remember on exactly which dates it had occurred. He insisted that the turbidity had been due to the low vacuum on the pump suctions and the higher pumping rate. This rate, however, was estimated to be only about 10 per cent above the average.

Samples of the water for bacterial and chemical examination were taken at several points by the department engineer and carried immediately to the laboratory for examination. At the end of one day, inoculations for the determination of the presence of B. coli indicated the probability of the presence of those organisms in all the samples, and in as small a quantity as 1/10 c.c. in one sample. It was also noted that the chlorine content of the chemical sample was about twice that of the content of the samples previously taken. These results, together with the fact that the explanation given by the attendant in charge of the waterworks as to the reason for the turbidity in the water seemed inadequate to the engineer making the investigation, made it appear advisable that a thorough inspection of the plant and wells should be made. This inspection was made on March 24. The results of the examination can be clearly explained only by a detailed description of the arrangement of the pumping station, the wells, and the connecting pipes.

The water supply of the city of Schenectady is obtained from three dug wells at the waterworks pumping station, located about 2½ miles west of the city on a flat piece of land lying between the south bank of the Mohawk river and the hills which rise abruptly from the plain about 1,000 feet south of the river. Wash borings made a short time before the investigation indicate that the soil in the vicinity of the waterworks consists of clayey loam from the surface to a depth of 12 feet, the lower 2 feet containing considerable gravel; from a depth of 12 feet to a depth of 60 feet, a sharp coarse sand mixed with gravel containing a considerable proportion of stones several inches across; and below 60 feet, an impervious clay. Whereas the surface of the ground is practically level, the surface of the impervious stratum beneath the gravel appears to slope gently toward the wells from three directions, and away from the wells or toward the river, or northerly direction, in the fourth. The wells extend through the upper 12 feet of loam into the gravel stratum from which they receive their water. They are arranged in a line parallel to the river and about 400 feet from it. A highway leading into Schenectady, and the Erie canal, both parallel to the Mohawk river, lie between the wells and the river, the canal being the nearer to the stream.

Well No. 1, the oldest and most westerly of the three, is 60 feet long, 8 feet wide, and about 42 feet deep. The walls, of masonry and of considerable thickness, are built of large cut stones, the lower courses apparently having been laid without mortar. The roof is formed by a well constructed arch about 22 feet below the surface of the ground. Near the center, a short section of the well extends to a point within a few feet of the surface of the ground, and a manhole in the roof of this section gives access to the well for inspection. The bottom of the well is the gravel encountered at that depth when the well was dug. At the time of the inspection the water in the well was clear and colorless. The walls and roof of the central section were wet, but there were apparently no material leaks. The places where the old suctions, described below, from the pump house to the river, had passed through the walls of the well were visible, but the patches which closed the openings originally occupied by the pipes were apparently tight. Open joints between the stones forming the walls of the well were clearly visible below the water line.

Wells Nos. 2 and 3 are circular in form, 42 feet in diameter, and about 40 feet deep. The walls are of concrete, and the roofs are apparently made of reinforced concrete supported on steel beams which span from the walls to the Phoenix columns set in the centers of the wells. As in the case of well No. 1, the bottoms are formed by the natural gravel. These two wells were, at the time of the inspection, in an entirely satisfactory condition. The three wells are connected by castiron siphons said to be 16 inches in diameter, one between well No. 1 and well No. 2, and the other between well No. 2 and well No. 3, arranged to allow the water to flow from one well to the other. The pump suctions connect to wells No. 1 and No. 2. As near as could be learned from the available records, the level of the water in the wells, with the pumps running, is usually about 210 feet above mean tide, and that in the river is 2 feet higher, or about 212 feet above mean tide. At times however the water rises as much as 20 feet above these levels.

Originally, the pump house now in use contained two large steam-driven reciprocating pumps which were connected to well No. 1, and were also provided with two 24-inch suctions extending to the Mohawk river. These two suctions passed out through the wall of the basement of the pump house about 18 feet below the surface of the ground, extended through two converging pipe galleries to well No. 1, crossed through the raised central section of that well, mentioned above, and continued in two parallel pipe galleries to a manhole at the road about 30 feet north of the well. From this point the pipes extended through the ground without galleries to the river. The galleries are about 6 feet across and 8 feet high. The walls and arched roofs are constructed of brick. The galleries are not paved, the bottom being formed by the gravel encountered in excavating them. Two manholes, one on the south side of well No. 1 and the other at the side of the road about 30 feet north of the well, afford access to the galleries. The suction pipes had been removed from the galleries, and the holes through the walls of the well and through the wall of the basement of the pump house had been sealed with concrete and brick. The portions of the pipes from the gallery to the river still remained in place. One of these pipes, the westerly one, was sealed with concrete. The other pipe, the easterly one, was apparently open from the river to the gallery.

The existence of these galleries and the fact that they could be reached by manholes, the covers of which were made visible by the melting of the snow, became known to the engineers from the Division of Sanitary Engineering of the State Department of Health on March 24, and they were immediately inspected. The galleries between the well and the road had apparently been full of water carrying considerable suspended matter a short time previous to the inspection. The bottoms were covered with a slimy deposit of black silt to a depth of from one-half inch to 2 inches, and the upper surfaces of all projections of the brick work to a height of about 8 feet above the bottom of the gallery were likewise covered with a deposit of the same material, the quantity of deposit being less on the higher projections. The deposit of sediment was practically uniform over the bottom of the galleries, except at points in both galleries about 10 feet from the north wall of the well. Here, in each gallery, there were several holes from 6 to 10 inches across on the top and extending from 1 foot to 2 feet down into the gravel in which the stones were perfectly clean, as if a swift stream had passed down through the coarse gravel at these points and carried with it all the silt and fine material.

The elevation of the bottom of the galleries is approximately 222.5 feet above mean sea level, or about 10.5 feet above the normal river level. An examination of the records of the river elevations kept by the lock tender at Barge Canal lock No. 8, about a quarter of a mile west of the pumping station, revealed the fact that the river had risen from an elevation of about 214 feet at noon on March 13 to 228 feet at midnight on that date, over one-half of the rise, 9 feet, occurring between 2 and 3 o'clock. The river reached its maximum elevation of about 230 feet at 4 P. M. on March 14; and after that time the elevation gradually fell, reaching 224 on the 20th, and 222 feet on the 21st of the month. The elevation of the water in the wells, figured from the record of the vacuum on the pump suctions, rose more slowly than that of the water in the river, the maximum rate of the rise being about 1 foot per hour. The river elevation was, therefore, for a considerable time, several feet above the elevation of the water in the wells. On the afternoon of the 13th this difference varied from 6 feet at noon to about 14½ feet at 3 P. M., dropping again to 7 feet at midnight. During the entire day of the 14th the elevation of the river was a little over 6 feet above the elevation of the water in the wells, and from that date on gradually decreased, the difference on the 20th being only about 9 inches.

Compared with the elevation of the bottom of the pipe gallery, these figures indicate that the river surface was above the floor of the gallery from 3 o'clock on the afternoon of March 13 until March 20, and that during the afternoon of the 13th and during the 14th the river surface was between 6 and 8 feet above the bottom of the gallery while the water in the well remained below the bottom of the gallery.

Apparently, therefore, from the 13th to the 20th of March, there was nothing to prevent the polluted water of the Mohawk river from flowing from the river to the galleries through the open 24-inch suction line, then along the galleries, and as indicated above, down through the wash holes a few feet from well No. 1, and through a few feet of coarse gravel into the well either by way of the joints in the stonework or up through the open bottom. The largest rate of flow into the well by this means would, of course, have occurred on the 13th and 14th of the month, when the difference in elevation between the surface of the river and the surface of the water in the well was greatest, and would have gradually decreased as the difference in elevation became less. This is in general accordance with the evidence as to the turbidity in the city water, which is said to have been the greatest on the night of the 13th and during the 14th, gradually becoming less during the week and finally disappearing about the 19th or 20th.

An examination of the results of the analyses of the samples of water from the wells and system taken on March 20, several days after the high water, indicates that the water at the wells still contained polluted matter on that date, as shown by the examination for the presence of B. coli. The water in the city mains, probably pumped some hours before the samples were taken, and thus representing the condition of the water at the wells some time before the time of the inspection, showed evidences of being more polluted than the water taken direct from the wells at about the same time, as indicated by the presence of organisms of the B. coli type in 0.1 c. c. The examination of samples taken direct from the wells on March 24th showed that some polluting matter still remained in well No. 1 on that date, while the water from wells Nos. 2 and 3 was practically free from bacteria. All this evidence confirms the conclusion that the polluting matter entered well No. 1.

The possibility of the pollution of the city water supply by the river water could have been prevented had the waterworks officials been familiar with the piping at the station, given due attention to the elevations of the river, and stopped using the water from well No. 1 when the water of the river rose so high as to endanger the quality of the water from that well. This could have easily been done by closing a valve and breaking the seal of a siphon. Even if they had not observed the river elevation, the turbidity of the water which they noticed should have warned them that some unsatisfactory condition existed which they should have taken immediate steps to correct.

The open suction line and the probability of its being the cause of gross pollution of the water was at once pointed out to the superintendent of water of the city, and he immediately had the open pipe sealed. A report on the conditions was sent to the city authorities shortly afterward, in which it was recommended:

1. That the ends of the two 24-inch suctions in the gallery manhole between well No. 1 and the river be sealed with castiron flanges and suitable tight gaskets.
2. That at least two sections be removed from each of the old suction lines to the river at points between the gallery manhole and the high water line of the river and at a distance of not less than 30 feet from the manhole, the four ends thus exposed sealed with castiron flanges and tight gaskets and the excavation refilled with impervious material.
3. That the pipe galleries, unless removed entirely, be thoroughly cleaned.
4. That as previously recommended, the sewer carrying the sewage from the toilets in the pumping station and the chief engineer's residence be re-located as far from the wells as possible, and laid with castiron pipe with leaded joints and a suitable grade and at a reasonable distance below the surface of the ground.
5. That the work be carried out under careful and strict engineering supervision.

These recommendations, excepting No. 4, were carried out by the city authorities. The removal of the possibility of further pollution did not, of course, prevent the damage done by the gross pollution and infection of the water between March 13 and March 19. An epidemic of gastroenteritis disturbances occurred on March 15 and lasted for several days. On March 28, 15 days after the first pollution of the water, or 10 days after the day on which the inflow of polluted water into the river ceased, the records of the Division of Communicable Diseases indicated that one case of typhoid was reported. Others followed. On April 1 the onsets of eight cases occurred, and for the next week the number of onsets ranged from two to six, the number gradually decreasing. The last case was reported as occurring on the 19th. In all, there were 53 cases, 3 of which terminated fatally.

The water of this supply is used by the New York Central and Delaware and Hudson Railroads for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on November 19, 1920, and included, in addition to the analysis of a sample of the supply, the statement that at the time of the inspection the conditions surrounding the supply were satisfactory, and that the results of the inspection and analyses of the samples, together with the results of previous inspections and analyses, indicate that the water is of satisfactory quality for human consumption. A copy of the report accompanied this data. Based on this information the United States Public Health Service on November 17, 1920, issued a certificate permitting the use of the water for drinking and culinary purposes.

SCHENECTADY COUNTY TUBERCULOSIS SANATORIUM

An investigation of the water supply at the Schenectady County Tuberculosis Sanatorium was made on January 15, 1920, by Mr. Earl Devendort, assistant engineer in this Department.

The plans for the present water supply were approved by this Department on October 15, 1918, and consisted of a small reservoir formed by a dam, and a pump house containing coagulation and sterilizing devices, pumping equipment, and pressure filters. The water is pumped after sedimentation and sterilization through pressure filters, where it is treated with alum, to underground storage tanks. The rate of application of chlorine, according to the statement of the superintendent, varies from .9 to 1.6 p. p. m. available chlorine.

This investigation was made as a result of a reported outbreak of intestinal trouble at the institution in which 10 patients out of the total population of 108 were affected. The outbreak of intestinal trouble was first brought to the attention of the authorities of the institution on January 8, 1920, through complaints of several of the patients. Workmen were engaged from December 1, 1919, to January 9, 1920, in replacing a section of the force main, and about January 1 and 8, respectively, the reservoir was drawn down to enable the workmen to make proper connections. About December 1 one of the two 24-inch Roberts pressure filters cracked and was put out of service, since which time only one filter has been in operation.

As a result of the above investigation it was concluded that the outbreak of intestinal trouble at the institution was occasioned by the breaking of one of the filter units, and the making of changes in the distribution system which gave opportunity for pollution to enter the distribution system, and by intermittent and ineffective chlorination of the water supply. It was accordingly recommended that the broken filter be replaced and put in operation as soon as possible; that the hypochlorite solution be applied at all times in proper amounts, and that the present method of applying hypochlorite solution be improved by extending the end of the pipe through which the hypochlorite solution enters the sedimentation chamber to the open end of the suction pipe, or by introducing the hypochlorite solution directly into the suction line of the pump through a constant head orifice tank in which only the settled hypochlorite solution is allowed to enter, the solution being mixed in a different container.

SCHENEVUS

A reinspection of the public water supply of the village of Schenevus was made by Mr. W. J. Erickson, sanitary inspector in this Department, on October 15, 1920, previous inspections of this supply having been made by this Division in 1908 and 1915.

Schenevus is a village of about 560 inhabitants. It is located in the southeastern part of Otsego county, about 15 miles northeast of Oneonta, on the Delaware and Hudson Railroad. The public supply, which is used by about 90 per cent of the inhabitants of the village, is owned and operated by the Schenevus Water Company.

The supply is derived from a small stream known as Sparrow Hawk brook. The water is impounded by three reservoirs located 4, 2¼, and 2 miles from the village respectively. From the upper storage reservoir the water flows over the natural stream bed to the second or intake reservoir. From this intake reservoir the water is piped to the distributing reservoir a short distance below, from which the water is supplied by gravity through about 5 miles of water mains varying from 4 to 6 inches in diameter. The average consumption is about 40,000 gallons daily. A spring located in a field just northeast of the village supplies some 15 houses.

The watershed tributary to the brook supply is about 1½ square miles in area. The stream flows through a long narrow valley the sides of which are practically cleared of timber and devoted to agriculture. There are 8 occupied houses and a schoolhouse on the watershed, with a total population of about 20, or about 13 per square mile. Most of these live in the village, occupying the houses on the watershed during the summer months only.

The sanitary conditions on the watershed are about as described in the previous report. All the privies along the stream are located 50 or more feet from the stream and are provided with concrete containers, the contents of which are removed and buried yearly by the water company. A good proportion of the land has been purchased by the water company and so is under their control. The supply is, however, subject to wash from cultivated fields and pasture lands. The vitrified tile has been delivered at the Jeffrey farm but has not yet been laid, though it is the intention of the company so to do in the near future. This tile is to be laid so as to divert the stream around the farm building and thus prevent contamination of the supply.

The spring is located in a field and fenced to prevent trespassing. It is covered with a substantial slate covered hip roof. It appears that there is no possibility of contamination except from surface wash from the surrounding fields entering through the cracks in the collecting basin.

It was therefore recommended that the company consider the installation of some modern method of water purification for improving the sanitary quality of the supply.

SCHOHARIE

A reinspection of the public water supply of the village of Schoharie was made on October 13, 1920, by Mr. W. J. Erickson, sanitary inspector in this Department, a previous inspection of this supply having been made in 1915.

Schoharie, which is a village of about 1,000 inhabitants, is located in Schoharie county, about 35 miles west of Albany. Practically all of the population use the supply which is owned by the village. The water supply is derived from a spring located on the side of a hill about a mile and a half northeast of the village. At times the spring supply is augmented by pumping from Fox creek.

The spring issues from a cavern in a small ravine on the side of the hill. From this cavern the water flows to a small intake reservoir about 50 feet below. There are no permanent sources of pollution on the watershed above the spring; this area, however, is largely used for pasturage or cultivated. The immediate vicinity of the spring and reservoir is fenced, but it is possible that at times surface wash reaches them from the surrounding pasture lands. It seems probable that this wash from pasture lands and from trespassers are the only sources of pollution.

The Fox creek, from which the auxiliary supply is derived, is the outlet of Warner's Lake. From the lake the stream flows through several communities. The area of the watershed is about 110 square miles on which there is a population of about 4,350, or 39 per square mile. The stream was followed from the intake to Berne, a distance of about 11 miles above. At Berne there are four privies which discharge directly into the stream. At West Berne there are about 10 privies located from 10 to 25 feet from the stream, and a slaughter house with carcasses and excreta strewn in the rear near the edge of the bank above the stream. At Gallupville, about 4 miles above the intake, conditions are not as serious as at West Berne. There are several privies near the millrace. The creamery mentioned in the previous report has been abandoned. Besides these direct instances observed, it seems probable that the main stream and its tributaries are subject to pollution from farms and pasture lands along their banks. The water of the creek cannot be considered as suitable for a public water supply unless the direct sources of pollution are eliminated and the water properly treated.

As a result of the reinspection it was recommended that the spring supply be adequately protected by the construction of drainage ditches to prevent surface wash from entering the spring and intake reservoir, that the village authorities take immediate steps to develop an additional supply of satisfactory sanitary quality so as to render the auxiliary use of Fox creek unnecessary, and that pending the development of the additional source the Fox creek supply be efficiently sterilized should the use of this source become necessary.

SCHROON LAKE

A reinspection of the public water supply of the village of Schroon Lake was made on July 31, 1920, by Mr. Earl Devendorf, assistant engineer in this Department, previous inspections of this supply having been made by this Division in 1914 and 1916.

The village of Schroon Lake is an unincorporated village in the southern part of Essex county, at the northern end of Schroon Lake. The resident population is estimated at 300, while the summer population is several times this number. The water supply is owned and operated by the Schroon Lake Water Company. The supply is derived by gravity from a small spring fed reservoir located in the hills some two miles west of the village, supplemented by water from Bullet pond.

As a result of the above investigation it was concluded that no steps have been taken to develop the supply from King brook and Horseshoe pond brook, and that while the water taken from both the reservoir and from Bullet pond is not subject to any permanent sources of pollution, it is, however, as is true of all surface supplies, subject to the accidental or willful contamination from trespassers upon the watershed, and in the case of the reservoir subject to surface drainage from the surrounding pasture land.

It was therefore recommended that the water company develop an adequate supply of water of unquestioned quality, either by acquiring new sources of supply as recommended in the previous reports, or by the treatment of the present supply, and that as previously recommended the company secure the services of a competent sanitary engineer to advise and aid in carrying out these improvements.

SEA CLIFF

A reinspection of the public water supply furnished by the Sea Cliff Water Company to the village of Sea Cliff and the unincorporated villages of Glen Head and Glenwood, Nassau county, N. Y., was made on July 15, 1920, by Mr. Alfred Mullikin, assistant engineer in this Department, a previous inspection of this supply having been made by this Division in 1915.

Sea Cliff is located in the northwestern part of the town of Oyster Bay, about 29 miles from New York city. The winter population is about 2,500, and increases in the summer to about 5,000, due to the influx of residents from the city. The waterworks are owned and operated by the Sea Cliff Water Company. There are eleven 6-inch wells, from 65 to 85 feet deep, of which two only, about 60 feet deep, are in use; three 10-inch wells about 55 to 60 feet deep, two only of which are in use; and three 8-inch wells about 55 to 60 feet deep, all of which were driven in the year 1918. The stratum through which the wells pass is white sand.

The watershed tributary to the supply is on a precipitous slope and is sparsely populated, the houses consisting of high class cottages. Possibilities for indirect pollution were not apparent at the time of the inspection, with the exception of the sewer line leading from the pumping station to the harbor. This sewer line consists of a 4-inch castiron pipe from the building for a distance of nearly 40 feet, which is about half its length, the remainder being of tile pipe. It is possible that sewage may escape into the ground from the joints in the tile pipe. The nearest buildings are about 250 feet from the wells and it would seem that there is little opportunity for contamination of the well water in the immediate vicinity of the wells from the buildings. There is no sewerage system for the village. Privies are in general use, and in some cases cesspools have been constructed. Private sewers which formerly ran into the harbor have been practically all abondoned.

As a result of the reinspection it was recommended that the authorities in charge of the water supply eliminate all possible sources of pollution by reconstructing the sewers within 500 feet of the wells with castiron pipe laid with lead joints; by carefully protecting the wells from surface wash; and by taking steps to have all cesspools within a distance of 500 feet of the wells made water-tight, and all privies within the same distance provided with metal containers, and to have the contents of such receptacles removed at proper intervals to some remote place for disposal.

SENECA FALLS

An investigation of the sanitary condition of the public water supply of the village of Seneca Falls, Seneca county, N. Y., was made by Mr. Henry Ryon, assistant engineer in this Department, on April 1 and 2, 1920, subsequent to an epidemic of gastroenteric disturbances which occurred during the several days following March 13, 1920.

Seneca Falls is a village of about 7,000 inhabitants located three miles west of the north or outlet end of Cayuga lake. The water supply of the village is derived from the lake and is treated in pressure mechanical filters before being delivered to the consumers. The average daily consumption is about 1,500,000 gallons and the average per capita consumption about 214 gallons. The waterworks are owned and operated by the Seneca Falls Water Company.

Cayuga Lake, the source of the water supply of the village, is about 37 miles long and from 1 to 3 miles across, the area of its water surface being about 65 square miles. The lake forms a part of the New York State Barge Canal system, and control gates have been installed at Mud Lock, on the outlet of the lake, by which its level may be varied to suit the requirements of the canal. The watershed of the lake has a total area of 863 square miles. The 797 square miles not including the water area is covered principally by farm lands, but has on it several municipalities, including Ithaca, Aurora, Cayuga, Dryden, Freeville, Newfield, Trumansburg, and Union Springs. The total population on the watershed is estimated at about 30,000.

At the north end of the lake the Seneca river, now a part of the New York State Barge Canal, discharges just above the outlet and control gates at Mud Lock. This river at the outlet of Cayuga Lake has a watershed of 730 square miles, including 86 square miles of water surface in Seneca and Keuka lakes. The character of the watershed is very similar to that of Cayuga Lake. The river, however, below the outlet of Seneca Lake receives the sewage of Geneva, Waterloo, and Seneca Falls. Normally the flow of water in Cayuga Lake is northward, and the polluted water of the Seneca river when it reaches the lake mixes with the lake water and flows north through the outlet. When the control gates at Mud Lock are closed or partially closed so that the flow from Cayuga Lake and the Seneca river is greater than the outflow through the gates at Mud Lock, the polluted water of the river backs up into the shallow north end of the lake for several miles and considerably past the intake of the waterworks. Information obtained from the engineer in charge of the operation of the locks in the vicinity, however, revealed the fact that the gates at Mud Lock had been closed most of the winter, and were opened on March 21 a few days prior to the inspection but subsequent to the outbreak of the epidemic of gastroenteric disturbances in Seneca Falls. On account of the ice no one was able to give, from personal observation, any information as to the direction of the currents in the lake during the month of March. It is certain, however, due to the fact that the gates at Mud Lock were closed and there was a heavy runoff, that the flow was in a southerly direction, or from the outlet toward the waterworks intake, for several days prior to the opening of the gates on March 21, 1920, and that the polluted water of the Seneca river reached the intake during that period.

The filter plant consists of four units, each 6 by 22 feet in size, giving a total area at the diameter of the cylinders of about 700 square feet, or 0.016 of an acre. The rate of filtration is approximately 94,000,000 gallons per acre per day. The loss of head through the filters varies from 2 to 7 feet. They are washed at intervals of about 38 hours, the process requiring approximately 15 minutes. After washing the filtered water is wasted for 10 minutes. Alum is used as a coagulant and is applied from a solution tank in the pump room that is connected to the main suction pipe. There is no coagulation basin. The alum is generally applied at a rate of from 0.1 to 0.6 grains per gallon, depending upon the quality of the raw water. No record of the turbidity of the raw water is available, but the thaws and rains about the 13th are known to have greatly increased the flow of the streams at that time, and it is probable that the turbidity and amount of pollution of the lake at the waterworks intake reached its maximum shortly after, due largely to the fact that the increased runoff and the closed gates at Mud Lock undoubtedly caused the water of the polluted and then turbid Seneca river to flow southerly into the lake in large quantities. The quantity of chemical applied, however, was not increased until the 17th.

According to the statements of the health officer of the village and others, there were a large number of cases of gastroenteric disturbances in the village during the latter part of March. These cases could apparently be traced to no common cause except the water supply. The first cases appeared about the 15th of March, and the epidemic continued for a week, the number of cases gradually diminishing. On the 12th and 13th of the month, 2 days prior to the outbreak, there were heavy rains in the vicinity accompanied by a rise in temperature which melted considerable snow, and the runoff of the watershed was probably the largest of the year. During this period the gates at Mud Lock were closed, and although there is no evidence based on actual observation to support the fact, it is probable that in addition to the large inflow of surface drainage from the natural watershed of the lake, the water of the polluted Seneca river undoubtedly backed into the lake beyond the waterworks intake. There was at this time a noticeable increase in the turbidity of the lake water, and according to the statements of the engineer at the pumping station, a marked decrease in the alkalinity. Statements from the people of the village indicate that there was a slight increase in the turbility of the water supply, but that this was apparently not very marked. No figures were available to indicate quantitatively the change in the physical and chemical character of the water, and no bacteriological test had been made during this period from which information regarding the degree of pollution of the raw water could be obtained. The pollution was, however, undoubtedly quite serious, for the water of the Seneca river which flowed south to the waterworks intake was very turbid and polluted with sewage to such an extent that particles of floating sewage solids could be seen in it. The fact that the character of the raw water was materially changed and undoubtedly carried an unusual amount of polluting matter just prior to the outbreak of the gastroenteric disturbances, seems to indicate that the water supply was the cause of the outbreak. In connection with this it should also be noted that similar outbreaks of intestinal trouble have occurred in previous years, always following a change in the quality of the raw water.

As a result of this investigation it was recommended that suitable apparatus for the chlorination of the water supply of the village be immediately installed, and that liquid chlorine be applied to the water continually at all times in such proportion as may be found necessary and at a rate of not less than 0.2 parts per million; that the required rate of application of the chlorine to the water be determined daily by tests for excess chlorine in the treated water made at the filter plant, and that the chlorine be applied in such quantities as the tests indicate are necessary; that the condition of the raw water be carefully watched, and the quantity of coagulant applied be regulated in accordance with the results of daily tests, and that a coagulation basin having a capacity equal to not less than 2 hours flow be constructed and used in connection with the operation of the plant.

SHARON SPRINGS

A reinspection of the public water supply of the village of Sharon Springs was made by Mr. Earl Devendorf, assistant engineer in this Department, on October 8, 1920, a previous inspection of this supply having been made by this Division in 1915.

Sharon Springs is a village located in the northwestern corner of Schoharie county, on the Cherry Valley branch of the Delaware and Hudson railroad. The population is variable, being about 500 in winter and 3,500 during the summer months. The public water supply is owned by the village and operated under the direction of a water board.

The supply is mainly derived from a stream and small lake of approximately 60,000,000 gallons capacity, located some 4 miles southwest of the village. An intake pipe extends some 300 feet into the lake, through which the water flows by gravity to a reservoir located about ¼ of a mile below the lake. The reservoir has a capacity of about 3,000,000 gallons. The supply is also partially derived from 2 springs located about 1½ miles west of the reservoir and near the headwaters of the stream feeding the reservoir. From the reservoir the water flows by gravity through pressure mechanical filters, located near the village, to the distribution system in the village.

The lake from which the supply is derived is fed by a small stream draining a sparsely populated watershed of approximately 1 square mile in area. The slopes are steep and the larger part of the area is used for grazing and agricultural purposes. Several buildings are located near the stream. The north spring of the 2 from which the spring supply is derived is located in a ravine above all houses and is not directly subject to pollution. The spring basin is walled with stone sides on which a small wooden house is built provided with a wooden door. The south spring is located in a field below a farmhouse and undoubtedly receives some drainage from the farm.

The purification plant consists of 3 pressure mechanical filters of the International Filter Company type. The filters are 8 feet in diameter and 5 feet in height. Assuming a water consumption of 100 gallons per capita per day, the rate of filtration with all the filters in operation is 101,000,000 gallons per acre per day when the population reaches 3,500, the maximum during the summer months. Provision is made for applying alum by means of the shunt system, but at the time of the inspection alum was not being applied. It is the practice to discontinue the use of the filters between the months of November and May inclusive.

As a result of the reinspection it was concluded that the public water supply of Sharon Springs is in practically the same condition as that described in the former report made in 1915, and that the recommendations made in that report have not been carried out; that the officials in charge of the public water supply have employed an engineer to study the conditions for the purpose of eliminating the shortage of water among the residents living in the higher section of the village during the summer months when the hotels, located in the lower section of the village, are using large quantities of water; that while the filters were being operated at the time of the inspection, alum was not being used, and that it has been the practice to discontinue the operation of the filter plant between the months of November and May each year; that the results of the analyses of samples taken at the time of the inspection indicate that little or no purification was being obtained by the purification plant.

It was therefore recommended that the officials in charge of the public water supply carry out the recommendations made in the former report; that steps be taken to improve the distribution of the supply to the residents located in the higher sections of the village; that the officials in charge of the public water supply operate the plant in the future in such a manner as to secure a satisfactory purification of the water supply, using adequate amounts of alum at all times; and that the filter plant be operated during the winter months.

SHELTER ISLAND HEIGHTS

A reinspection of the public water supply of the village of Shelter Island Heights was made on June 7, 1920, by Mr. Alfred Mullikin, assistant engineer in this Department, a previous inspection of this supply having been made by this Division in 1915.

Shelter Island Heights is located in the northwestern part of Shelter Island, in the town of Southold, about ¾ of a mile south of the village of Greenport. The waterworks are owned and operated by the Shelter Island Heights Association.

The water supply is derived from three dug wells, Nos. 1, 2 and 3, each having a separate pumping station. The water is supplied to the consumers by pumping it through a distributing system consisting of approximately 6 miles of concrete lined steel pipe. The water from wells Nos. 1 and 3 is pumped into a low service system, the surplus going to an elevated wooden tank having a capacity of 20,000 gallons. The water from well No. 2 is pumped into a steel tank having a capacity of 54,000 gallons, which takes the surplus and acts as an equalizing reservoir. The water from the high pressure service is supplied to about 10 cottages.

As a result of the inspection of the public water supply of Shelter Island Heights, it was concluded that the authorities in charge of the water supply have in part carried out the previous recommendations of this Department; that there are no cesspools or privies or other visible permanent sources of pollution in the vicinity of the wells; that there remain certain opportunities for serious pollution of the water due to the fact that the ground around wells Nos. 1 and 2 is not fenced to prevent people from trespassing upon it, and by leakage from tile sewers in the vicinity.

It was therefore recommended that the association authorities in charge of the water supply maintain a careful sanitary patrol in the vicinity of the wells at all times; that the reserved areas at wells Nos. 1 and 2 be fenced to prevent trespassing, and the grade arranged to turn surface water which might enter either way from the wells; and that all sewers within a radius of 500 feet be relaid with castiron pipe and lead joints in order properly to protect the ground water from dangerous contamination.

SIDNEY

A reinspection of the public water supply of the village of Sidney was made on September 23, 1919, by Mr. Earl Devendorf, assistant engineer in this Department, previous inspections of this supply having been made by this Division in 1908, 1909, and 1913.

Sidney is a village located in the northeastern part of Delaware county, on the Susquehanna river. The resident population is about 3,000, nearly all of whom are served by the public water supply. The waterworks were owned and operated by the Sidney Water Works Company at the time of the inspection but were to be transferred to the city. The supply is derived by gravity from impounding reservoirs on Collar brook and Peckham brook. The Collar brook supply consists of four impounding and storage reservoirs located one above the other in a rocky ravine. In the bottom of the second lowest reservoir there is a sand and gravel strainer. There are also two crude open gravity mechanical filters located in the bottom of the lowest reservoir, from which the water is led into the distribution system. The capacities of the reservoirs, starting with the lowest, are respectively 288,000, 4,398,000, 4,819,000 and 13,424,000 gallons, making a total storage of approximately 23,000,000 gallons on this watershed. The total drainage area tributary to the reservoirs on Collar brook is about 1.6 square miles, consisting largely of farm land and woods. Farm houses are located well back from the brook, with the exception of a vacant one owned by the water company.

The supply derived from Peckham brook is stored in an impounding reservoir, and is filtered through two gravity mechanical filters located at a point about 2½ miles northwest of the village. This reservoir has an estimated capacity of 43,000,000 gallons. The filters, located midway at the dam in an arched masonry chamber, are said to consist of ungraded sand and gravel over which is approximately 22 feet of water. The area of the watershed above the Peckham reservoir is approximately 5 square miles, and consists largely of farm and pasture land with a considerable percentage of wooded land. Several sources of contamination exist on the watershed. It is estimated that approximately two-thirds of the water supplied to the village is derived from the Peckham brook supply.

As a result of the reinspection it was recommended that the village authorities in charge of the water supply carry out our former recommendations as soon as possible; that ice cutting on the reservoir be discontinued; that as previously recommended the existing sources of pollution on the watershed be removed, and if any difficulty be experienced in this matter, application be made to this Department for the enactment of rules and regulations for the sanitary protection of the water supply; that the present filters be abandoned and a modern filtration plant be installed; that in the meantime, pending these improvements, the supply be sterilized by the application of liquid chlorine; and that in view of the complicity of this problem, the village employ a competent consulting engineer to study the matter and prepare plans for the proper improvements of the supply.

SODUS POINT

An inspection of the water supply of Sodus Point was made by Mr. Earl Devendorf, assistant engineer in this Department, on May 28, 1920.

Sodus Point is an unincorporated village of about 500 inhabitants located in the northern part of Wayne county, some 15 miles north of Newark, on the shore of Lake Ontario. The village is not furnished with a public water supply, being served by private wells; neither is there any public sewer system, the inhabitants using cesspools and privies.

The water supply is obtained from two wells known as Main's well and the Lake Shore well. The Main's well is a dug well 22 feet in depth and had about 8 feet of water in it at the time of the inspection. The well is provided with a chain pump for drawing the water. A concrete curb and cap prevents surface wash from entering the well directly. The nearest possible source of pollution is a privy located in the rear of the houses at a distance of 50 feet from the well and at an elevation of approximately 5 feet below the ground surface near the well. The Lake Shore well is located approximately 300 feet from the shore of Sodus bay, at an elevation of about 15 feet above the water surface in the bay. The privy used at the Harris house is located south of and above the well at a distance of approximately 100 feet from it. This well is a drilled one, and is said to be 160 feet in depth. The ground surrounding the well is properly graded and a concrete platform provided so that there is no opportunity for surface wash to enter the well directly. The water is lifted from the well by means of a deep well pump.

As a result of the inspection it was recommended that the privies near Main's well and the Lake Shore well either be removed to a point at least 100 feet away from and below the wells, or suitable removable containers be provided and properly maintained in order that the excreta may be satisfactorily removed and disposed of by burial at a point where it will not pollute the ground water supplying the wells; that frequent analyses be made of the water of these wells in order that any breaking down in the natural purification afforded by filtration through the soil may be immediately detected, and should any evidence of such a failure be noticed, steps be immediately taken to treat the water by suitable means, or if possible to remove the source of pollution, and that the authorities in charge exercise due care and precaution to prevent any possible pollution from entering the well supply.

SONYEA (Craig Colony for Epileptics)

Plans for additions to the water supply system of the Craig Colony for Epileptics at Sonyea, consisting of architect's drawing No. 2026, were submitted to this Department for approval on June 10, 1920. The plans provided for excavation and improvements of an existing pond to be used as a storage reservoir, and certain pipe lines and appurtenances connected with the reservoir. After careful consideration by the Engineering Division the plans were approved on July 16, 1920. On July 24, 1920, amended plans, making certain minor changes in the pipe lines and appurtenances connected with the reservoir, were submitted to this Department for approval, and approved on July 27, 1920.

SOUTHAMPTON

A reinspection of the public water supply of the village of Southampton was made on June 5, 1920, by Mr. Alfred Mullikin, assistant engineer in this Department, a previous inspection of this supply having been made by this Division in 1915.

Southampton is located in the town of Southampton, about 91 miles from New York city. The village proper is a residential district with a population varying from 2,500 in the winter to 5,000 during the summer. The waterworks are owned and operated by the Southampton Water Works Company.

The water supply is derived from 5 driven wells about 85 feet deep, located some 1,500 feet north of the railroad depot, or about 1½ miles north of the central part of the village. From the wells the water is pumped into steel storage tanks under air pressure which forces the water through a distributing system consisting of about 30 miles of castiron pipe.

The area owned by the water company is about 45 acres, of which 20 acres have been reserved for the protection of the water supply. A part of this area has been planted with small pine trees. There are no houses located on this area, the immediate vicinity also being sparsely settled. The nearest house is more than 500 feet distant from the wells. The toilet for the pumping station is provided with a metal container, and the contents are disposed of by burying in the ground some 50 feet east of the plant.

As a result of the reinspection it was recommended that the authorities in charge of the water supply maintain a careful sanitary patrol in the vicinity of the wells to discover and eliminate all possible sources of pollution, and that the contents of the container of the pumping station toilet be removed to and disposed of by burial at a place not less than 500 feet distant from the wells.

SOUTH NEW BERLIN

A reinspection of the public water supply of the village of South New Berlin, Chenango county, N. Y., was made by Mr. N. H. Baier, sanitary inspector in this Department, on November 24, 1920, a previous inspection of the supply having been made by this Division in the year 1917.

South New Berlin is located in the towns of New Berlin, Morris, and Butternuts, about 40 miles south of Utica. The present population is 350, of which 93 per cent is served by the public water supply. The waterworks are owned by the South New Berlin Water Company.

The water is derived from springs which flow into two catchbasins located about ½ mile east of the village. From these basins the water flows by gravity to a covered masonry reservoir of 100,000 gallons capacity. This reservoir takes the surplus from the Owens springs and all the water from the Grover springs, and acts as an equalizing reservoir. The water is delivered by gravity through a distributing system. The watershed of the springs consists of pasture and forest land which is hilly and of a gravelly subsoil. The Owens springs appear to be well protected from surface wash. The Grover springs, however, while concreted and banked to prevent the entrance of surface wash, are located where pollution from pasture land may enter the springs by intermittent filtration through the gravelly soil.

For an auxiliary supply, two 6-inch wells of 265 feet depth have been used, one owned by the Water company, the other by the Nestles Food Company, formerly the Borden's Condensed Milk Company. The wells are within a short distance of each other and located near the fairly well built-up section of the village.

As a result of the reinspection it was recommended that the authorities in charge of the water supply enclose a sufficient area about each of the Grover springs adequately to protect them from pollution; that the walls of the Grover springs catch-basin be raised to prevent the entrance of surface wash; and that a more substantial roof covering, similar to that at the Owens springs catch-basin, be constructed to prevent the entrance of accidental or willful pollution into the basin; that if after all possible precautions have been taken to safeguard the supply of the Grover springs from pollution the supply is still found to be unsatisfactory, then a new source of supply be sought; and that a rigid sanitary patrol of the land around the springs be maintained.

SPRING VALLEY

A reinspection of the public water supply of Spring Valley, was made by Mr. W. J. Erickson, engineering assistant in this Department, on June 18, 1920, a previous investigation of this supply having been made in 1916.

Spring Valley, which a village of about 3,000 population, is in the southern part of Rockland county. The water supply is owned and operated by the Spring Valley Water Works and Supply Company.

The supply is derived by pumping from two wells located in the northern part of the village. From these wells the water is pumped into the storage reservoir and from there to the distribution system consisting of 10 miles of water mains in Spring Valley and 25 miles in the districts outside the village, ranging from 4 to 20 inches in diameter. The consumption in the village is about 166,000 gallons daily, and that of the outer districts about twice as much.

The two wells from which the supply is obtained are located about 100 feet from the pumping station, near the road and a few feet from a small stream. These wells are 8 inches in diameter and driven to a depth of about 400 feet. For the first 30 feet they pass through sand, gravel, and clay, and for the remaining distance through rock (Newark sandstone). The wells are cased to a distance of about 6 feet into the rock. The suction lines are connected with the wells at points about 12 feet below the surface of the ground. Nine wells have been driven but only the two referred to are being used.

The storage reservoir is located on a low hill about 300 feet from the pumping plant and wells. It is 175 by 250 feet in plan and 16 feet deep. Pressure is maintained by a standpipe located about half a mile east of the pumping station. This standpipe is 20 feet in diameter and 100 feet high, with a capacity of about 235,000 gallons. Generally the water from the standpipe supplies Spring Valley only, and the supply for the outer districts is taken from the reservoir.

The watershed of the stream flowing by the wells is approximately 2.6 square miles, on which there are about 50 houses, with a total population which may be estimated at 250, or about 96 per square mile. It seems probable that, although the stream receives a moderate amount of pollution from surface wash of this populated area, the possibility of polluting the wells is remote, except by percolation through crevices in the rock or along the outside of the well casings. Furthermore, the location of the wells on the outskirts of a village unprovided with public sewers does not assure that the well supply will continue to be free from pollution in view of the presence of many leaching cesspools and privies within the zone of possible influence. The natural drainage in the village is, however, away from the wells.

It was therefore recommended that the waterworks company continue to maintain a system for the collection and analysis of samples of water from the supply in order to detect the presence of any active contamination which may at any time occur; that in case such analyses indicate the occurrence of active contamination the waterworks company take immediate steps to determine and eliminate the cause and source of such contamination; and that in case it is found impossible or impracticable to eliminate completely the cause and source of such contamination, the waterworks company consider the installation of suitable apparatus for sterilization of the supply with liquid chlorine.

STAATSBURG

A reinspection of the public water supply of the village of Staatsburg, Dutchess county, N. Y., was made on October 26, 1920, by Mr. N. H. Baier, sanitary inspector in this Department, a previous inspection of this supply having been made by this Division in 1915.

Staatsburg is located in the northwestern part of the town of Hyde Park, 11 miles north of the city of Poughkeepsie. The present population is 600, of which 75 per cent is served with water from the public supply. The waterworks are owned and operated by the Staatsburg Water Company.

The water supply is derived from a small stream which was impounded at a point about a mile east of the village. The reservoir thus formed is located about ¾ of a mile south of the origin of the stream. It has a capacity of approximately 30,000,000 gallons, which is equivalent to a three years' supply. At the time of the inspection the water was clear, although there was considerable growth of vegetation at a number of places in the reservoir. Copper sulphate is applied twice a year to prevent algae growth. The water from the reservoir passes to two covered filter beds of the slow sand type, each 18 by 60 feet in plan, containing about 2½ feet of sand supported on gravel. The combined area of the two beds is 0.05 of an acre, and the average rate of filtration about 600,000 gallons per acre per day.

As a result of the reinspection of the public water supply of Staatsburg it was concluded that the filtered water was of a satisfactory sanitary quality, although it contained considerable color and odor which can only be removed by special processes; that the raw water contained some active contamination and was highly colored, probably due to the large percentage of swamp land and the growth of vegetation in the reservoir; and that due to the low position of the intake, water containing an unnecessary amount of decayed vegetation is carried to the filter.

It was therefore recommended that the authorities in charge of the water supply continue to maintain a careful sanitary patrol of the watershed and operate the plant in an effective manner; that the reservoir be cleaned of its vegetation whenever necessary, and that copper sulphate be applied to the water in proper proportions at regular intervals to prevent the growth of algae and other microscopic organisms; that the present intake pipe at the reservoir be re-located so that water will be taken at a point nearer the surface of the water, preferably at a point 4 feet from the surface; and that the authorities consider the installation of an aeration plant to remove the odor from the water, and the draining of the swamp or the making of certain changes in the plant to eliminate the color.

STILLWATER (Public School)

An investigation of the water supply of the public school at Stillwater, Saratoga county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on October 29, 1920. The results of the inspection indicated that the existing well at the schoolhouse was subject to pollution from surface wash, waste water from the pump, pollution of the ground in the vicinity by those passing over it, and by seepage from several privies.

It was accordingly recommended that a new or additional source of water supply of safe quality and adequate quantity be obtained, either by increasing the depth of the present well or by the drilling of another well, or by such other means as may be found to be most practicable.

SUFFERN

A reinspection of the public water supply of the village of Suffern was made by Mr. Henry Ryon, assistant engineer in this Department, on June 9, 1920, previous inspections of the supply having been made in 1909, 1915, and 1916.

The village of Suffern is located in the western part of Rockland county, on the Erie railroad, 32 miles from New York. The population is about 3,000, all of whom are served with water from the public supply. The water for the public supply is taken from Antrim lake, on the Mahwah river, and chlorinated and filtered before being delivered to the consumers. The total water consumption is estimated at 175,000 gallons per day, or about 58 gallons per capita per day. The supply is owned by the municipality and is under control of a board of water commissioners. On account of the unsatisfactory conditions on the watershed, which have been described in previous reports, the village authorities are, at the present time, considering the development of a new source of supply.

To this end they have drilled a well on the waterworks property between the pumping station and the Mahwah river. This new well is said to be 340 feet deep. It is 10 inches in diameter for the first 65 feet and 8 inches in diameter for the remainder of the distance. The well is cased to rock, a distance of about 75 feet. According to the records kept by the board of water commissioners, the well passes through 25 feet of dry gravel, 20 feet of wet gravel, 20 feet of quicksand, 5 feet of rock (probably a boulder), 5 feet of wet gravel, and 265 feet of what is locally known as red rock (Newark sandstone). The well is located about 25 feet west of the west bank of the Mahwah river, and about 100 feet north of the Piermont branch of the Erie railroad. The surface of the ground at the well is 8 or 10 feet above the water elevation in the lake. The water in the well stands at approximately 12 feet below the elevation of the surface of the ground adjacent to it. The well has been tested by pumping for short periods, and the result of the last test, said to have extended over 84 consecutive hours, indicated that with the pump cylinder at a depth of 63 feet the well could deliver about 160 gallons per minute. There is some doubt, however, as to whether or not this rate can be maintained in the continuous operation of the plant.

The Newark sandstone, from which the water of the wells is apparently derived, underlies the larger part of Rockland county and extends southward into New Jersey, Pennsylvania, and Maryland. In New York State it extends from the Hudson river to the Ramapo mountains, stopping abruptly at the granite rocks forming those hills. Along the Hudson river and at Ladentown and Suffern, trap rock has been forced up through the sandstone. The sandstone is covered at most places with a layer of glacial drift, thicker in the valley than on the hills, composed of sand, clay, gravel and boulders. Judging from outcrops and places where the rock is exposed in cuts, the sandstone varies considerably in structure and composition. Some strata are of comparatively fine compact sandstone, and others are a coarse conglomerate containing a large percentage of quartz and limestone, pebbles and boulders, some 10 and 12 feet in diameter. Many of the layers are hard and almost impervious, while others are porous and so soft as to be easily crushed by the fingers. Where the rock is exposed it is generally creviced. In general, the dip of the strata is toward the west, the inclination in most cases being about 10 degrees. Just east of the new well and on the opposite side of the Mahwah river, a mass of trap rock known as Union hill has been forced up through the sandstone, and consequently the strata in the vicinity considerably disturbed. About ¼ of a mile west of the well the sandstone ends abruptly in a fault of unknown extent at the foot of the granite rock of the Ramapo mountains.

At Spring Valley, about 7 miles east of Suffern, the water supply of the Spring Valley Water Company is taken from wells in the Newark sandstone about 200 feet deep. The supply seems to be abundant. The hardness of the water averages about 70, and the chlorine content about 4. The bacteriological counts are generally high, and organisms of the B. coli type have once or twice been found in 10 c.c. inoculations.

A well said to be over 200 feet deep has been drilled on Union hill about ¼ of a mile east of the well and 100 feet above it. This well yields considerable water although there is no accurate record of its actual capacity. The water in the well is said to stand at a level of about 12 feet below the surface of the ground when the pump is not operating, which would seem to indicate that the water is probably of local origin and that there is not any direct connection between the rock at the surface and the rock from which the new village well receives its supply.

It seems probable, therefore, that if carefully developed the new well may yield a water of satisfactory sanitary quality. There are, however, apparently two ways in which the water of the well might become polluted: By leakage of surface water into the well where the casing joins the rock, or by polluting matter near the well or at a considerable distance reaching its water through the crevices in the rock; for as stated above, the strata in the vicinity of Suffern has been considerably disturbed and an examination of the outcrops and exposed places seems to indicate that the rock is badly creviced. If this well or other wells in the vicinity are developed as a source of water supply for the village, great care should be taken to make the connection between the well casing and the rock watertight, and the water should be constantly watched for indications of pollution. If such pollution is found and cannot be prevented, it will of course be necessary to chlorinate the water.

As a result of the reinspection it was recommended that the village authorities strictly enforce the rules and regulations for the protection from contamination of the water supply of the village, and construct sewers around the north shore of Antrim lake in accordance with the plans approved by this Department, or develop a new source of supply without delay; that the purification plant be carefuly operated at all times; and that if a new supply is developed by drilling wells in the vicinity of the present pumping station, the village acquire control of as much land as possible near the wells in order to be able to prevent its pollution; and enclose the area immediately adjacent to the supply by a fence and prohibit trespassing upon it.

SUMMITVILLE

An inspection of the water supply of the New York, Ontario and Western Railway Company at Summitville was made by Mr. W. J. Erickson, engineering inspector in this Department, on May 13, 1920.

Summitville is an unincorporated village in Sullivan county, about 33 miles southwest of Kingston, at the junction of the main line and the Monticello, Port Jervis and Kingston division of the New York, Ontario and Western railroad.

The supply, which is derived from a small mountain stream about 2 miles from the station, supplies the station, the hotel, and occasionally water tanks in the passenger coaches. It is developed by damming a small mountain stream flowing through a narrow rocky ravine. The dam forms a reservoir about 15 feet wide and 200 feet long. The watershed, which has an area of about ¾ of a square mile, is very steep and covered with underbrush and timber. A road passes parallel to the stream and crosses it in the upper section of the watershed. Only 1 house is located on the watershed: This is near the divide, and about ⅛ of a mile from the stream tributary to the reservoir.

At the time of the inspection samples were taken from the reservoir and from a tap in the station and sent to the Division of Laboratories and Research for analyses. These analyses show a water that is clear, colorless, and very soft. The figures for ammonia compounds and oxygen consumed were low, denoting small amounts only of organic matter. The chlorine content was higher than that for unpolluted water of this section. The total bacterial counts vary, being very high in the sample collected on May 13. Organisms of the B. coli type were present in all of the 10 c.c. inoculations tested, and in a third of the 1 c.c. inoculations, denoting considerable active contamination.

As a result of the inspection it was recommended that the present supply be abandoned as a source of drinking water and another supply of satisfactory sanitary quality be developed.

The water of this supply is used by the New York, Ontario and Western railroad for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on November 10, 1920, and included, in addition to the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were not entirely satisfactory, and that the results of the inspection and the analyses of the samples indicate that the water cannot be considered to be of an entirely satisfactory quality for human consumption. A copy of the report accompanied this data.

TANNERSVILLE

A reinspection of the public water supply of the village of Tannersville was made by Mr. A. I. Howd, assistant engineer in this Department, on October 13, 1920, a previous inspection of this supply having been made by this Division in 1916.

The village of Tannersville has a summer population estimated at 5,000, but during the remainder of the year the population is only 758 according to the census of 1915. It is located in the southeastern part of Greene county, on the Kaaterskill branch of the Ulster and Delaware railroad. The waterworks are owned and operated by the Tannersville Water Company.

The water supply is derived from a small spring brook about 2 miles northwest of the village. A dam constructed across the brook forms a small impounding reservoir from which the water flows by gravity to the village. An auxiliary supply is derived from Schoharie creek, about 2 miles south of the village.

The watershed from which the regular supply is derived is about 1 square mile in area and has a population of about 15 persons. The buildings are well removed from the reservoir and tributary streams. The shed is located on the side of a mountain and most of it is wooded. Golf grounds of a private club at Onteora Park are located on the watershed. There seems to be no direct source of pollution of the supply, but the watershed and reservoir are always subject to accidental or willful contamination by visitors on the watershed.

As a result of the reinspection it was again recommended that the water supply be sterilized with liquid chlorine during the summer when the supply is subject to pollution by visitors on the watershed; that the auxiliary supply derived from Schoharie creek be sterilized with liquid chlorine when it is necessary to use this supply; and that the authorities in charge of the water supply make frequent inspections of the watershed with a view to maintaining it in as sanitary a condition as possible at all times.

THENDARA (Fulton Chain)

An inspection of the public water supply of the village of Thendara (Fulton Chain) was made by Mr. Earl Devendorf, assistant engineer in this Department, on May 25, 1920.

Thendara is an unincorporated village located in the central part of Herkimer county, about 40 miles north of Utica. The population at the time of the inspection was estimated at 400, practically all of whom are furnished with water from the public supply. The water supply is owned by

Mr. Lyon DeCamp. The supply is derived from springs located on a hill ¾ of a mile west of the New York Central railroad station. A 4-inch pipe leads the water from the small intake to the village. The watershed is uninhabited. It has been burned over and at present is covered with berry bushes and second growth timber. No storage is provided. There are approximately 2 miles of water mains ranging from 1 inch to 4 inches in diameter.

As a result of the reinspection it was concluded that the water supply of Thendara as developed is of fairly satisfactory sanitary quality for an unpurified surface supply, although as is true of all surface water supplies, it is subject to direct contamination of either accidental or willful nature from hunters or trespassers on the watershed, and that the supply is depleted during periods of cold weather when the inhabitants allow the faucets to remain open to prevent freezing.

It was therefore recommended that the authorities continue a careful patrol of the watershed to prevent any contamination of the public water supply.

The water of this supply is used by the New York Central Railroad for drinking and culinary purposes in interstate traffic. Data regarding the supply were furnished to the United States Public Health Service on October 22, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were fairly satisfactory, and that the results of the inspection and the analyses of the samples, together with the results of previous inspections and analyses, indicate that the water was of satisfactory quality for human consumption. A copy of the report accompanied this data.

THIELLS (Letchworth Village)

Plans for proposed extensions to the water system to serve the girls' group at Letchworth Village, Thiells, Rockland county, N. Y., consisting of architect's drawing No. 2244, were submitted by the State Architect to this Department for approval on May 14, 1920, and after careful consideration by the Engineering Division were approved on May 20, 1920. Revised plans making minor changes in the arrangement of the piping were submitted for approval on July 21, 1920, and approved on July 27, 1920.

THOMPSON (School)

An inspection of the water supply of District School No. 10, at Thompson, Washington county, N. Y., was made by Mr. W. J. Erickson, engineering assistant in this Department, on December 2, 1919.

As a result of the inspection it was recommended that the school authorities obtain a new source of supply so located as to be free from all possible sources of contamination, or if this is not feasible, protect the present source of supply by repairing the lining of the well, providing a tight cover, fencing the area around it to prevent trespassing, arranging the level of the ground above flood water, and removing the school cesspools as far as possible from the well.

TONAWANDA

Inspections of the public water supply of the city of Tonawanda were made by representatives of this Division on January 21, 1920, March 17, 1920, and October 19, 1920. Special attention was given to the chlorination of the water at these times, on account of the fact that there had been several cases of typhoid in the city due to the failure of the chlorination apparatus during the previous year.

VALATIE (Farm Colony)

An investigation of the water supply of the Farm Colony of the Rome State School for Mental Defectives at Valatie, Rensselaer county, N. Y., was made by Mr. Henry Ryon, assistant engineer in this Department, on August 25, 1920.

The main water supply of the institution is derived from a 6-inch drilled well about 60 feet deep, located 200 feet south of the more southerly of the 2 buildings of the institution. There seemed to be little chance of pollution reaching this well except by the entrance of water from the floor of the pump house. The cottage is supplied from a spring in a small ravine just east of the building, located immediately below the chicken-yard and hog-yard and also below the cesspool serving the cottage.

As a result of the inspection it was recommended that to supply the immediate needs of the institution the present well be operated for a longer period each day, either by keeping an attendant at the pump house or by equipping the pump with an automatic controlling device; that provided it is not intended to increase materially the population of the institution, an additional well be constructed on the plain near the buildings, and connected to the system of the institution; that the floor of the pump house be so arranged that it will be impossible for water falling on it to flow into the well; and that a new source of supply of unquestioned sanitary quality be developed at the cottage.

VALLEY JUNCTION

An inspection of the public water supply of the depot of the New York, Ontario and Western railroad at Valley Junction was made by Mr. W. J. Erickson, engineering assistant, on May 14, 1920.

Valley Junction is located on the Neversink river, in the western part of Orange county, about 8 miles northeast of Port Jervis.

The water used for the wash basins and flushing the public toilets and by the station master's family in the depot is derived from a deep well located in the corner of the cellar under the baggage room. The well is said to be about 300 feet deep drilled mostly through gravel. There is a 16-inch tile casing which is said to extend to the bottom of the well, inside of which is a 2-inch suction pipe which is also said to extend to the bottom of the well. The top of the casing is about 2 feet above the cement floor of the cellar and is apparently tight so that none of the overflow goes back into the well. The water is pumped into a pressure tank by a hand pump. There is a drain for the cellar about 10 feet from the well. This part of the cellar was used for no purpose other than housing the pump, and was clean at the time of the inspection.

The sewer pipe which conducts the wastes from the dwelling and toilets passes 25 feet from the cellar wall, or about 35 feet from the well, to a cesspool which is approximately 100 feet from the well, at about the same elevation as the top of it. This is the only source of possible pollution within half a mile of the well.

The well is about a quarter of a mile from the Neversink river, which at this point has a watershed of over 500 square miles. The watershed directly tributary to the well is about 4 square miles. There are about 7 dwellings on it, housing about 30 people, making the population approximately 7 persons per square mile.

It was recommended that the present well be abandoned and another constructed at such a location as to be free from possible contamination, or the present sewer and cesspool be re-located and reconstructed.

The water of this supply is used by the New York, Ontario and Western railroad for drinking and culinary purposes. Data regarding the supply were furnished to the United States Public Health Service on October 19, 1920, and included, in addition to the results of the analysis of a sample of the water, the statement that at the time of the inspection the conditions surrounding the supply were not entirely satisfactory, and that the results of the inspection and the analyses of the samples indicate that the supply cannot be considered to be of satisfactory quality until the present well is abandoned and another constructed at such a location as to be free from possible contamination, or the present sewer and cesspool be re-located and reconstructed in accordance with our recommendations. A copy of the report accompanied this data.

WAPPINGERS FALLS

A reinspection of the public water supply of the village of Wappingers Falls was made by Mr. Earl Devendorf, assistant engineer in this Department, on November 5, 1919, a previous inspection of this supply having been made by this Division in 1918.

Wappingers Falls, a village with a population of about 4,000, is located in the southwestern part of Dutchess county, 8 miles south of Poughkeepsie and 1½ miles east of the Hudson river. The pumping station and filtration plant are owned by the Garner Print Works, and the distribution system and standpipe are owned by the village. At the end of a certain period, by the payment of amortization charges, the village will own the entire plant.

The water supply is derived from Wappingers creek, the intake being from a large penstock which leads from a millpond in the northeastern part of the village to the hydraulic power equipment of the Print Works. From the intake the water is passed through a coagulating tank, two filter beds, and a clear water well, from which, after chlorination with about 0.24 parts per million gallons, it is pumped through the distribution system. The average daily water consumption is approximately 200,000 gallons daily, or about 100 gallons per capita.

The watershed tributary to the intake is about 200 square miles in area, and consists of a moderately well populated farming district with a resident population of about 10,000, or 50 per square mile. There are 2 incorporated villages located on the watershed, neither of which has a public water supply or sewerage system. Opportunities for indirect pollution of the water supply streams by surface wash from the vicinity of farm houses, barns, highways, railroads, and cultivated fields are fairly numerous.

As a result of the reinspection it was concluded that the officials in charge of the water supply have in part carried out the recommendations in our previous report, and that the purification plant was being operated in a satisfactory and efficient manner at the time of the inspection; and that the existence of cross connections between the fire system at the Print Works and the village distribution system provides opportunity for contaminated water to enter the village mains at times of test on the fire pump or during fires. Furthermore, the possible introduction of raw water into the distribution system within the mill affords opportunity for careless or ignorant use of this water, when contaminated by raw water from the fire pump, for drinking purposes by the employees of the mill.

It was therefore recommended that the officials in charge of the water supply continue to maintain careful and efficient supervision of the operation of the purification plant in order that the supply may be at all times of a satisfactory physical and sanitary quality; that the village authorities apply to this Department for the enactment of rules and regulations for the sanitary protection of the watershed tributary to this supply; and that the auxiliary raw water supply at the Print Works be connected with the fire system of hydrants and sprinklers only, and that the remaining distribution system within the mill be supplied with purified village water only. Should it be necessary to cross the village system with the mill fire system, double check valves of an approved type and properly installed should be provided for such cross connections.

WASSAIC

A reinspection of the public water supply of Wassaic was made by Mr. W. J. Erickson, engineering assistant in this Department, on May 27, 1920, a previous inspection having been made in 1915.

Wassaic, which is an unincorporated village of about 200 inhabitants, is located in the town of Amenia, in the eastern part of Dutchess county. The water supply is owned and controlled by the Wassaic Water Company. About 70 use this supply.

The water supply is derived from two springs located about a mile north of the village. The water flows by gravity directly into the distribution system and to the storage reservoir. The distribution system consists of about a mile and a half of 2- to 3-inch wrought-iron pipe, on which there are 18 service taps, none of which are metered. A well is located near the center of the village from which an auxiliary supply is obtained.

The springs from which the supply is obtained are located on the slope of a hill. Immediately above the springs the water apparently flows underground for about 400 feet, while above this it seems to flow above ground after issuing from the rocks of the mountain higher up. The area through which the water flows over the ground is about 3 acres in extent, and is fenced so as to prevent trespassing. The source of the springs is probably in a shale or shist formation with considerable limestone. In times of drought the spring fails. The water is collected in two basins 3 feet square about 15 feet apart. They are built of stone masonry and have flat wooden covers. From the springs the water is piped to the village through a 2-inch pipe.

The reservoir is located on the hillside about half way between the village and the springs. It is constructed of concrete and is covered with a wooden roof. The reservoir is said to be cleaned and the mains flushed out about once a year.

An auxiliary supply is obtained from a dug well located about 25 feet from the Ten Mile river and about 500 feet from the Wassaic creek. The well has been excavated to a depth of 4 feet, below which 6 feet of 10-inch tile has been sunk. It was found impractical to sink the well farther because the water entered it faster than it could be pumped out, due apparently to the rapid infiltration of the creek water through the coarse sand and gravel.

The area above the springs from which they probably derive their water is about half a square mile in extent. There are no houses on it and the only pollution is from the cattle pasturing above them. The springs are practically dry at certain seasons of the year.

The extent of the watershed tributary to the well is of course difficult to determine. However, the area between the streams and in which the well is located is practically flat. The village east of Ten Mile river is located on a hill and at a higher elevation than that of the well. On the flat area there are about 9 houses from 300 to 400 feet from the well, and about 15 houses within 500 feet from it. About 20 feet southwest of the well is a barnyard in which a manure pile was stored. About 50 feet north of the well is an empty pig-pen. It was stated that this pen has not been in use for some time. The nearest privy is about 125 feet west of the well, and there are privies and cesspools for practically all the houses in the village. Their condition is such that they undoubtedly pollute the ground in the vicinity, which pollution may reach the well. The watershed of the Ten Mile river which flows near the well is about 12 square miles in area. The stream undoubtedly receives some pollution above the well in passing through the village, and since the ground is very porous there is a chance that when the well is drawn down some of this polluting matter may reach the well.

It was recommended in the report dated September 10, 1920, that the water company permanently discontinue the use of the well supply, or remove as far as possible the unsatisfactory conditions immediately surrounding the well, and provide effective filtration or sterilization of the supply; that the fence around the spring be extended; and that the company endeavor to increase the supply by further developing the springs or obtaining water from a new source so as to make the use of the well water unnecessary.

WATERLOO MEMORIAL HOSPITAL

An inspection of the proposed water supply for the Waterloo Memorial Hospital, in the village of Waterloo, Seneca county, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on July 17, 1920.

As a result of the inspection it was found that the dug well near the hospital, which the authorities in charge of the hospital contemplated using as a source of water supply in preference to the village supply, would probably yield a water of satisfactory sanitary quality, but was subject to possible pollution from surface wash and possible contamination from a tile sewer. It was accordingly recommended, that should the water from the dug well be used for patients in the hospital, a sample of the water be sent to the Division of Laboratories and Research for analysis; and that should active contamination be found, the authorities immediately return them and eliminate if possible the source of pollution, and if this cannot be done, obtain water from some other source.

WELLSVILLE

A reinspection of the public water supply of the village of Wellsville was made by Mr. E. S. Chase, assistant engineer in this Department, on March 19, 1920, previous inspections of the supply having been made by this Division in 1917 and 1918.

Wellsville is an incorporated village located in the southern part of Allegany county, on the Erie railroad, 27 miles west of the city of Hornell. The present population is estimated at approximately 5,500, of which practically all are served with the public water supply. The waterworks are owned and operated by the village under the direction of a board of water and light commissioners.

The supply is derived from the Genesee river, the intake being located about ½ mile south of the village. The river water is pumped to a 3,000,000 gallon raw water reservoir on a hill in the northern part of the village, and then flows by gravity through three units of slow sand filters located adjacent to the reservoir into a 500,000 gallon clear water basin, from whence it is distributed by gravity to the village. The average water consumption during 1919 was 577,000 gallons daily. The waterworks system and purification plant remain practically the same as described in detail in these previous reports.

From the inspection and the facts obtained thereupon it appears that there are certain faults which should be corrected. The intake should be so protected that its silting up will be avoided in the future; the direct connection between the old Worthington pumps and the distribution system should be broken; the chlorination plant at the pumping station should be kept in service continuously; the outlet from the raw water reservoir should be provided with an extension above the bottom of the reservoir so as to obtain the benefits of sedimentation therein; and the filter beds should be overhauled and re-sanded. Consideration should also be given to the construction of another unit of filters, and the filters should be covered with a layer of earth and sod to prevent freezing. At the earliest possible time the dirty sand in the filters should be removed and replaced by clean sand. An automatically controlled chlorination apparatus should be installed for chlorinating the filtered water, and should be in operation continuously. Heat should be provided for the building in which this apparatus would be housed. Furthermore, in view of the various difficulties which have been experienced in the operation of the waterworks system, a competent consulting engineer should be retained to go over the system in order to advise the village as to the best means of placing the works in a proper condition.

WESTBURY

A reinspection of the public water supply furnished by the unincorporated village of Westbury to Westbury, Wheatley Hills, Old Westbury, and Carle Place, Nassau county, N. Y., was made by Mr. Alfred Mullikin, assistant engineer in this Department, on May 28, 1920, a previous inspection of this supply having been made by the Division in 1915.

Westbury is located in the southwestern part of the town of North Hempstead, on the main line of the Long Island railroad, about 24 miles from New York city. The present population is estimated at 5,000. Of the total population, 40 per cent are served with water from the public water supply. The waterworks are owned and operated by the municipality and controlled by the village board of water commissioners.

The water supply is derived from 4 driven wells, 506, 360, 224, and 228 feet deep, located in the western part of the village some 2,000 feet northwest of the railroad depot at Winthrop street and Hicks lane. The two deeper and older wells are now used only in case of emergency. The water is obtained by air lifts and flows into a receiving well. From this receiving well it is delivered by pumping into a distribution system consisting of some 6 miles of castiron pipe. The daily water consumption in the summer amounts to approximately 300,000 gallons per day or 150 gallons per capita, while in winter the consumption amounts to approximately 250,000 gallons per day or 125 gallons per capita.

No specific sources of contamination were noticed in the vicinity of the pumping plant. The area of land reserved by the municipality for the pumping station measures approximately 100 feet by 300 feet. There are 15 or more houses located within a distance of 500 feet, and one privy about 75 feet northeast of the new wells. The houses are provided with cesspools and privies, there being no sewerage system in the village. The toilet provided for the pumping station is located in the southwest corner of the old section of the building, and the sewage is taken care of by two cesspools, connected in series, located some 20 feet south of the building. The effluent from the second tank seeps through open block tile drain into the ground. The pumping plant as a whole, consisting of the machinery and wells, is kept in excellent condition and can well be considered a model plant.

As a result of the reinspection of the public water supply of Westbury, it was concluded that the water supply at the time of the inspection was apparently of a satisfactory sanitary quality, but that the municipal authorities in charge of the water supply have in part carried out the previous recommendations of this Department; that there remain certain possibilities for serious contamination of the water supply due to the close proximity of the privies and cesspools to the wells, and the fact that under certain hydraulic conditions caused by the variations of the ground water flow and the excessive drafts on the wells they may pollute the water supply by percolation through the soil.

It was therefore recommended that all privies within a radius of 500 feet of the wells be provided with watertight containers, and all cesspools within that distance be made impervious and that they be maintained in satisfactory condition and properly cleaned whenever necessary and the contents disposed of in a sanitary manner in some remote place; that a sewerage system be constructed to take care of the houses within the immediate vicinity of the plant; and that the authorities maintain a careful sanitary patrol within the vicinity of the wells at all times in order to locate and eliminate any possible sources of pollution.

WEST HAVERSTRAW (New York State Hospital for the Care of Crippled and Deformed Children)

Plans for additions to the water supply system serving the New York State Hospital for the Care of Crippled and Deformed Children at West

Haverstraw, Rockland county, N. Y., consisting of architect's drawing No. 2029, were submitted to this Department for approval on August 6, 1920. After careful consideration by the Engineering Division, the plans were approved on August 11, 1920.

WINDSOR

A reinspection of the public water supply of the village of Windsor was made on May 18, 1920, by Mr. W. J. Erickson, engineering assistant, a previous inspection of this supply having been made by this Division in 1915.

Windsor, a village with a present population estimated at 750, is located in the southern part of Broome county, on the Susquehanna river. Practically the entire population is served by the supply. The waterworks are owned and operated by the village.

The water is derived from a small upland watershed about 2 miles northeast of the village. At times of drought it is necessary to supplement this supply by pumping from a driven well located about a quarter of a mile south of the village. From the intake the water is delivered to the consumers through a distribution system consisting of 4 miles of castiron mains ranging in size from 4 to 8 inches in diameter. The well supply is pumped into mains against the pressure maintained by the storage reservoir.

The upland supply is developed by the construction of a masonry dam about 15 feet long and 2 feet high across a small brook. This dam diverts the water into a small masonry chamber 5 feet by 8 feet in plan and 5 feet deep. From this chamber the water flows into an 8-inch main leading to the village. The intake end of the main is covered with a metal screen.

The watershed tributary to the upland supply is approximately 0.5 of a square mile in area; about half of this is covered with timber and the remainder is cultivated land and pasture. There are but 2 houses on the watershed, and both of these are about a quarter of a mile from the stream. The chief source of contamination is surface wash from manured fields. There is also the ever-present possibility for incidental, accidental, or willful contamination due to chance visitors on the watershed. The inadequacy of this supply, while due partly to the small size of the watershed, is also due in part to the incomplete development of the stream and the small storage. It is intended to better develop the supply by the construction of a concrete dam which is to form a reservoir which is also to be used for storage.

The reservoir is located on a hillside southwest of the village. It is circular in plan, with vertical sides, and is constructed of concrete. The reservoir is surrounded by an embankment which excludes surface wash and is surrounded by a high wire fence and by a low fine mesh wire screen around its perimeter.

The well from which the auxiliary supply is obtained is located about a quarter of a mile east of the reservoir and is about 50 feet from the highway running south from the village and about 500 feet from the west bank of the Susquehanna river. The nearest house is about 200 feet from the well, at a higher elevation. Within a radius of a quarter of a mile of this well the population may be estimated at about 500 per square mile. The watershed tributary apparently to the well may be estimated at .529 mile, most of which is used for pasture land or is under cultivation. At times of floods and ice jams the area in the vicinity becomes flooded, but at these times there is an adequate supply from the upland source and the well is not used. The well is about 80 feet deep, and is said to pass through loam, gravel, and rock, and finally to water bearing gravel. It is probably cased to the rock. A shed is provided over the well. The pumping station is a one-story concrete building located near the well. The pumping equipment consists of two Gould triplex pumps operated by 10-hp. Westinghouse motors. Each pump has a capacity of about 90 gallons per minute. The pump house and surroundings were not in a neat and well-kept condition at the time of the inspection.

As a result of the reinspection it was recommended that the village authorities make regular inspections of the watershed in order to detect and remove any source of contamination found thereon; that the upland supply be more adequately developed; that the pump house and surroundings be put in a neat condition; that no land within a radius of 100 feet of the well be fertilized or cultivated; that the area 30 feet in radius from the well be surrounded by a fence, and trespassing prohibited within it; that all privies within 500 feet of the well be provided with water-tight removable containers, and the contents of the containers disposed of in a sanitary manner at some remote place; that the casing be provided with a concrete collar so as to prevent surface wash from entering the well; and that should algae growths occur on the reservoir, the reservoir be emptied and cleaned thoroughly; and that the construction of a roof be considered.

WOLCOTT

A reinspection of the public water supply of the village of Wolcott was made by Mr. Earl Devendorf, assistant engineer in this Department, on September 27, 1920, a previous inspection of this supply having been made by this Division in 1915.

Wolcott is an incorporated village of some 1,300 inhabitants located on Wolcott creek, in the northeastern part of Wayne county. The water supply is owned by the village and operated under the direction of a board of trustees.

The supply is derived from springs located in the middle of a cultivated field about 2 miles southeast of the village. They are surrounded by a wire fence, but there are no drainage ditches to prevent surface wash from entering the small reservoir near the springs. The topography of the ground surrounding the springs, however, is such that there is little opportunity for surface wash to enter the supply except at times of spring thaws or very heavy rainfalls. The water flows by gravity from the springs to the pumping station in the village, where it is pumped into the distribution system.

The inspection was made as a result of a communication received from the local health officer informing this Department of a shortage of water and requesting information concerning a proposed auxiliary source of supply. At the time of the inspection it was learned that the village had engaged Mr. Charles C. Hopkins, consulting engineer of Rochester, to aid them in augmenting their present supply, and that he had advised them to build a storage reservoir to hold approximately 10,000,000 gallons of water, to be located just above the present pumping station.

As a result of the reinspection it was recommended that, as previously recommended, suitable drainage ditches be constructed about the springs and intake to prevent any surface wash from entering the water supply, and that if the proposed reservoir be constructed, care be taken to protect suitably the reservoir from both permanent and chance contamination.

WORCESTER

A reinspection of the public water supply of the village of Worcester was made by Mr. W. J. Erickson, sanitary inspector in this Department, on October 15, 1920, a previous inspection of this supply having been made by this Division in 1916.

Worcester is an unincorporated village of about 1,300 inhabitants located in the eastern part of Otsego county, 20 miles northeast of Oneonta. The water supply is owned and controlled by the Worcester Water Company. There are no public sewers in the village; septic tanks, cesspools, and privies are in general use.

The supply is derived from a small lake known as Caryl lake. From this lake the water flows by gravity through about 7 miles of mains varying from 4 to 10 inches in diameter. The average daily consumption is estimated at about 120,000 gallons.

Caryl lake, from which the supply is derived, has an area of about 40 acres and an average depth of about 20 feet. The level of the lake has been raised 2 feet by the construction of a small concrete dam. The intake is several feet below the surface and about 75 feet from shore at the southern or outlet end of the lake.

The lake has a watershed about 0.16 square mile in area. The village has purchased practically all land bordering the lake except a small stretch of woods on the eastern shore. The area purchased has been fenced and pine trees have been set out around the intake end. The two dwellings mentioned in the report on the 1916 inspection were located in the area purchased by the village, and there are now no permanent sources of pollution on the watershed. A shack located in the woods on the eastern shore is about 50 feet from the shore of the lake. There were evidences of this shack being used for the stabling of horses. The area in this part of the watershed is rather flat and swampy and is apparently used to some extent for pasturing.

It was therefore recommended that the water company continue to take every precaution to keep the supply in a satisfactory sanitary condition at all times.

YOUNGSTOWN

A reinspection of the public water supply of the village of Youngstown was made by Mr. Earl Devendorf, assistant engineer in this Department, on June 11, 1920, previous investigations of this supply having been made by this Division in 1915 and 1917.

Youngstown is an incorporated village located in the northern part of Niagara county near the mouth of the Niagara river, and has a population of about 600 inhabitants. There is no public system of sewers, although there are several individual sewers discharging into the river at a point above the intake of the public water supply. The public water supply is taken from the Niagara river at a point near shore and receives only that purification which is afforded by passing the water through a pressure mechanical filter. It is stated that the supply is not used by the residents for drinking or culinary purposes, local private wells furnishing such supply.

At the time of the inspection the operator at the pumping station was not present, and therefore could not be interviewed as to the schedule of operation of the filter plant; neither could the amount of alum being used, which is applied by means of the shunt system, be determined. It is evident, however, that beyond the application of alum the operating conditions of the water purification plant remain practically the same as at the time of our last inspection. Some agitation, however, has recently been started for the purchase of a chlorination plant, although no definite decision has been reached.

In view of the above facts it may be concluded that the public water supply of the village of Youngstown as derived from the Niagara river is grossly polluted, and that the present filter plant as operated does not effectively remove all contamination, and that the local officials in charge of the public water supply have failed to carry out the former recommendations of this Department as to the installation of the chlorination plant, which together with the present filter plant should if properly operated provide a water of satisfactory sanitary quality.

It was therefore recommended, that as previously recommended, the village authorities secure the services of a competent engineer to advise them as to the best and most economical means of making the necessary changes in the waterworks plant in order to provide a safe and wholesome water at all times; and that the village authorities immediately install a chlorination plant, and that the apparatus after installation be operated at all times in a satisfactory and effective manner so as to obtain a proper degree of bacterial purification.

INVESTIGATIONS OF COMPLAINTS RELATING TO STREAM POLLUTION

INVESTIGATION OF COMPLAINTS RELATING TO STREAM POLLUTION

The pollution of the watercourses of the State is a matter affecting very closely the health of the people. With the increase of population and consequent increase in volume of sewage discharged into the watercourses of the State from municipalities, and with the increase in manufacturing establishments from which wastes of widely varying kinds are discharged, the pollution of the streams tends always to become greater. The greater demand upon the streams to supply water to the increased populations and its more extensive use for manufacturing and agricultural purposes requires that the purity of the water shall be carefully protected. Furthermore, the discharge into the watercourses of this State of sewage, industrial wastes, and other refuse is a source of many complaints made each year to the Department. These complaints usually come from property owners and other persons directly affected by nuisances arising from stream pollution. Very often requests for assistance and advice in dealing with cases of stream pollution come from local boards of health or other municipal officials.

Where such procedure is feasible, the complaints are referred to local boards of health for suitable action under the provisions of the Public Health Law, but in many cases it becomes necessary for the Engineering Division to make careful investigations and prepare reports describing the conditions found to exist and the extent to which they give rise to nuisance or menace to health. Copies of these reports containing conclusions and recommendations as to the remedial measures which should be taken are then transmitted to the local authorities.

The reports upon the more important of such cases which came before the Department during 1920 are given below, and a list is also appended of all other cases.

BOONVILLE

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

DEAR SIR.— I beg to submit the following report upon an investigation of alleged objectionable conditions created by the improper disposal of wastes from the factory of the Boonville Condensed Milk and Cold Storage Company, Inc., at Boonville, Oneida county, N. Y., which was made the subject of complaints to this Department. Briefly stated, the substance of the complaints is that the whey and other wastes from the Boonville Condensed Milk and Cold Storage Company are discharged into the Black River Canal and a small creek which flows along lower Schuyler street, creating insanitary and objectionable conditions which are detrimental to the health of the community.

The investigation was made on May 25, 1920, by Mr. A. I. Howd, assistant engineer in this Department, accompanied by Dr. J. W. Douglas, health officer of the village of Boonville. The factory, the stream and its surroundings, were carefully inspected, and several residents living in the vicinity were interviewed.

The factory of the Boonville Condensed Milk and Cold Storage Company, Inc., of which Mr. Frank Rogers is president, is located in the southeastern part of the village of Boonville between the New York Central railroad tracks and the Black River canal. The Boonville Condensed Milk and Cold Storage Company assumed ownership of the plant on April 1, 1920, but the Boonville Creamery and Cold Storage Company, the former owners of the plant, continued to operate the cheese factory temporarily for the new owners, who were engaged at the time of the inspection in the construction of a new condensary. It was stated that the new firm would take over the milk business about August 1, 1920, and become engaged in the manufacture of condensed milk. At the time of the inspection the factory was engaged in the manufacture of cheese and butter, employing five men. About 29,000 pounds of milk were received daily, about 2,000 pounds of cheese manufactured, and about 750 pounds of butter made daily. The proposed condensary will have a capacity of 150,000 to 200,000 pounds of milk daily.

The water supply of the factory of the Boonville Condensed Milk and Cold Storage Company is obtained from the public water supply of the village of Boonville. The factory is provided with a flush closet which discharges sewage directly into the Black River canal. When the canal is empty the sewage flows down the bank of the canal and creates insanitary conditions.

In general, there are two classes of industrial wastes to be disposed of from the factory: The first is whey, which amounts to about 3,000 gallons daily, about one-third of which is taken away by farmers; the second class of wastes consists principally of wash water from floors, cans, and apparatus, and contains slight quantities of whey, curd, and other matter. No estimate could be given as to the amount of water used daily for washing purposes.

The whey is pumped through a 1¼-inch pipe to an open vat, 5 feet by 18 feet by 13 feet deep, located outside the factory building. The surplus overflows the vat and runs, together with the whey that leaks out of the vat, through a ditch onto the bank of the canal. The canal, which was empty at the time of the inspection, contained quantities of whey and decomposing organic matter. The waste water and washings are collected by floor drains and discharged through a 4-inch castiron pipe down the bank of the canal.

When the canal is empty, the wastes from the factory flow down the bed of the canal in a northerly direction, together with the water from a small stream which enters the canal a short distance south of the factory. The wastes and water flow through the canal for about 2,000 feet and then divide, a portion flowing on through the lock near Schuyler street and the other portion flowing into a small creek, an outlet of the canal. This creek flows along lower Schuyler street for several hundred feet, crosses Schuyler street, shortly after which it unites with Mill creek. Mill creek flows in a northeasterly direction and discharges into the Black river, from which the water supply of the city of Watertown is derived.

The milky wastes could be traced in the canal for several hundred feet below the plant, but no objectionable odors could be detected except in the immediate vicinity of the plant. Several hours previous to the inspection, water was run into the canal through the Forestport feeder and allowed to run out through the creek along lower Schuyler street. Such a volume of water was flowing through the creek at the time of the inspection that it was impossible to observe the former condition of the creek. It was alleged by people living in the vicinity that the bed of the creek was covered with a thick slime, red in color, which gave off a very disagreeable and offensive odor, and that on account of the odor they were obliged to close the doors and windows of their houses. It was stated by people interviewed that the objectionable conditions occur only in the spring when the canal is empty and there is very little water flowing down the creek, but as soon as the canal is filled with water the wastes from the factory become sufficiently diluted and there is enough water flowing down the creek from the canal to prevent the creation of conditions of nuisance.

These conditions concerning which complaints have been made may also be due partly to the discharge of sewage from the village into the canal and the creek. The village of Boonville, practically all of which is served with sewers, has, however, no comprehensive and systematic system of sewerage. As far as could be learned, the village began a number of years ago to construct sewers and drains and discharge them into the small streams flowing through the village. From time to time additional sewers have been constructed by citizens, by the village corporation, and some by joint effort of the citizens. Generally speaking, the sewage from the western part of the village discharges into Mill creek, while the sewage from the eastern part discharges into the Black River canal. A large sewer serving a portion of the eastern part of the village discharges into the canal near the stream, the outlet of the canal, which, flows along the south side of lower Schuyler street. The houses on the south side of this street have private sewer connections to the creek, while the sewage from the houses on the other side of the street is collected by a sewer in the street and discharged into the creek on the north side of the street.

As a result of this investigation it seems that the insanitary and objectionable condition of the small stream which flows along lower Schuyler street, in the village of Boonville, is caused both by the discharge of wastes from the factory of the Boonville Condensed Milk and Cold Storage Company, Inc., into the Black River canal, and by the discharge of sewage from portions of the village of Boonville into the Black River canal and the stream. The discharge of sewage from the sewers in the village and of wastes from the factory into the Black River canal constitutes direct violations of the Public Health Law, since no permission has been granted by this Department for the discharge of sewage from the sewers in the village or for the discharge of wastes from the Boonville Condensed Milk and Cold Storage Company, Inc.

These violations of the Public Health Law should be called to the attention of the village authorities and the owners of the factory. The owners of the factory should be advised to provide some proper method of treatment of the wastes from the cheese factory and the condensary before their discharge into any watercourse. The company should employ a competent sanitary engineer to advise them as to the most feasible and satisfactory method for the treatment of the wastes from their plants, and plans showing the proposed method of treatment should be submitted to this Department for approval in accordance with the provisions of the Public Health Law.

The sewage from the village of Boonville is, generally speaking, disposed of in an improper and insanitary manner. The question of sewerage conditions in Boonville has been before this Department on previous occasions, and the authorities have been advised to prepare plans for and construct a comprehensive sewer system and sewage disposal works. With certain additions, alterations, and extensions, it would seem that the existing sewers might be incorporated into a comprehensive sewerage system, the sewage from which might be conveyed to some point for treatment and ultimate disposal. The unsatisfactory and insanitary conditions that are now created in the village of Boonville could be eliminated in an economical, sanitary, and permanent manner. The village authorities should therefore be advised to employ a competent sanitary engineer to prepare plans showing the existing sewers and the proposed sewers which will provide the village of Boonville with a comprehensive sewerage system, and showing a disposal plant for the treatment of the sewage. These plans should be submitted to this Department for approval in accordance with the provisions of the Public Health Law.

In view of the above facts I therefore recommend:

1. That the Boonville Condensed Milk and Cold Storage Company, Inc., be advised to employ a competent engineer to prepare plans for the treatment of wastes from the factory and condensary at Boonville, the plans to be submitted to this Department for approval.
2. That the village authorities of Boonville be advised to employ a competent sanitary engineer to prepare plans for a comprehensive system of sewerage and sewage disposal plant for the village, and to construct as soon as possible such portions of the system and disposal plant that may be necessary to eliminate the present objectionable and insanitary conditions created by the discharge of the sewage into the Black River canal and Mill creek.

I further recommend that copies of this report be sent to the local board of health of the village of Boonville, to the sanitary supervisor of the district, to the Boonville Condensed Milk and Cold Storage Company, Inc., and to the village authorities.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *August* 26, 1920

Copies of this report were sent on August 27, 1920, to the village authorities, to the local board of health, and to the Boonville Condensed Milk and Cold Storage Company, Inc.

CANANDAIGUA

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

DEAR SIR.— I beg to submit the following report on an investigation of the pollution of Canandaigua outlet by the sewage and trade wastes from the city of Canandaigua, Ontario county, N. Y. This investigation was made on July 20–23 and August 12, 1920, by Mr. W. C. Emigh, assistant engineer in this Department, as a result of complaints received from town and village authorities below Canandaigua in regard to such pollution.

Canandaigua is an incorporated city of about 8,000 inhabitants. It is situated at the foot, or the northern end, of Canandaigua lake, and at the head of the outlet which bears the same name. It is the county seat of Ontario county, and is located near the center of that county. The city is on the Auburn branch of the New York Central railroad, and is the northern terminus of the Northern Central division of the Pennsylvania railroad. It is provided with trolley service to Rochester. Although there are several industries and factories in Canandaigua, the city is largely of a residential character. During recent years the increase in population has not been rapid. Census returns of 1890 show a population of 5,668; of 1900, 6,151; of 1910, 7,217; of 1915, 7,501. A report of the 1920 census shows a population about 150 less than in 1915. However, city officials familiar with the housing conditions at the present time and in 1915 are confident that these last returns are in error, as 100 more houses are now occupied than were occupied five years ago. In view of this, it is believed that the present population may safely be estimated at 8,000.

The water supply of the city is obtained from Canandaigua lake. The intake is located about 2 miles up the lake and 500 feet from shore in about 50 feet of water. This water is pumped direct to the mains and reservoir and is used without purification of any kind. Practically all of the inhabitants are users of this water. The average daily consumption approximates 1,000,000 gallons. This consumption varies somewhat with the seasons, being greatest during the summer months. About 150,000 gallons are used daily by the several industries and railroads.

Canandaigua outlet, into which the sewage and trade wastes of Canandaigua are discharged, flows from the lake about 8 miles in a northeasterly direction through Chapin, Shortsville, and Manchester; thence easterly about 12 miles through Clifton Springs and Phelps; thence northerly about 8 miles to Lyons, at which point it empties into the Clyde river.

Chapin is an unincorporated village with a population of about 100, located 4 miles below the head of the outlet. Shortsville, an incorporated village of 1,228 inhabitants, is located about 3 miles below Chapin. Manchester, an incorporated village of 1,115 inhabitants, is located about 1 mile below Shortsville. Clifton Springs, an incorporated village of 1,664 inhabitants, is located about 5 miles below Manchester. Phelps, an incorporated village of 1,375 inhabitants, is located about 5 miles below Clifton Springs. These statistics of population are based upon the census of 1915.

Previous Investigations and Data

By special act of the Legislature passed June 15, 1886, the village of Canandaigua was empowered to purchase lands along the outlet of Canandaigua lake and the water power at Chapin, located on that stream, and to construct a public sewer along the bed of the outlet for the purpose of obtaining drainage and sewerage for the village of Canandaigua. This act also made certain provisions for the artificial control of the flow of water from the lake into its outlet, with the evident intention of maintaining a sufficient flow at all seasons of the year to avoid the creation of a nuisance. Under the provisions of this act the village acquired certain property rights on both sides of the stream as far as Chapin. The dam at that point was removed for the purpose of maintaining an unobstructed flow through that section. The cost of these property rights and improvements totaled about $28,000.

The larger portion of the sewerage system of Canandaigua was built previous to the year 1903. In 1904 permits were granted by this Department for the construction of sewers on Hubbell and Catherine streets. In 1906 a complaint was received alleging that a nuisance and insanitary condition existed owing to the pollution of the outlet by the sewage of the village of Canandaigua. The complaint was investigated by a representative of this Department, who recommended that a settling tank be constructed to treat the sewage of the village before its discharge into the outlet, and that gates be installed and operated in such a manner as to regulate and equalize the flow of water from the lake into the outlet, thus avoiding the condition of small dilution during periods of minimum natural flow. In 1907 further complaints were received by this Department. In the fall of 1907 application was made by the village for permission to construct sewage in Lisk avenue and Gorham street. A provisional permit was granted for these sewers January 28, 1908, which permit expired January 28, 1910. It thus appears that these sewers, and any other sewers or sewer extensions which may have been constructed subsequent to 1905, are now used in violation of the Public Health Law.

Canandaigua became a city April 28, 1913. In that year further complaints were received by this Department regarding the pollution of the outlet by the sewage of the city. In 1916 complaints were again received of the pollution of the outlet. In this year a detailed investigation was undertaken by this Department in order that the exact degree and nature of the alleged pollution might be ascertained. The report of this investigation will be found in the 38th Annual Report, Volume II, page 171. As a conclusion of this report, it was stated that a nuisance existed at times in Canandaigua outlet owing to the discharge of the domestic and trade wastes of the city of Canandaigua into that stream. It was recommended that the City of Canandaigua be required to submit plans for sewage disposal works and to construct certain portions of same immediately. It was further recommended that the Lisk Manufacturing Company, the Canandaigua Gas Light Company, and the New York State Railways be required to construct separate and individual settling tanks or to connect their sewers and drains to the sewer system of the city of Canandaigua, or both.

Shortly after the completion of this investigation and report the nation became involved in war. As a result of conditions arising therefrom and in line with the general policy adopted by the State, certain projects which would otherwise have been prosecuted were deferred.

In July of this year resolutions were adopted by the town board of Manchester and Hopewell, and the village boards of the villages of Phelps, Manchester, Shortsville, and Clifton Springs, setting forth certain alleged conditions of pollution of Canandiagua outlet and public nuisances arising therefrom, due to the discharge into that stream of the sewage of the city of Canandaigua, and petitioning that action be taken by the State Department of Health to remedy the alleged conditions. In order that existing conditions might be accurately determined this investigation was undertaken.

Sewer System

The sewer system of the city of Canandaigua consists of about 17 miles of sanitary sewers and 9 miles of storm water drains. The system is divided into two districts, namely the west side system which includes about one-quarter of the city, and the east side system which includes the remaining three-quarters. The sewers on the west side vary from 8 inches to 18 inches. There is some roof water, but there are no catch-basins draining into the sanitary sewers. The sewer system serves about 90 per cent of the inhabitants, and the total average sewage flow was estimated to be about 1,000,000 gallons, or a quantity about equivalent to the water consumption. The outfall of the west side sewer is located in the bed of Canandaigua outlet about 400 feet below Main street. The east side sewer outfall is located in the bed of Canandaigua outlet about 300 feet below Saltonstall street.

Flow of Outlet and Dilution Factors

Canandaigua lake at its outlet has a watershed of 188 square miles. The surface area of the lake includes 18.6 square miles. The outlet has two channels for the first two miles of its length. The natural channel leaves the lake about one-half mile east of the foot of Main street, from which point it follows a winding course. The head of the artificial channel is at the foot of Main street, between the shipping dock and the swimming pavilion. The flow through both outlets is largely controlled by stop planks or weirs. During periods of low flow nearly all water is passed through the artificial outlet. It is thus possible to obtain a limited regulation of the dilution of sewage, all of which is discharged into the artificial outlet.

In the following table will be found the total flow of the two outlets during the month of each year in which the minimum mean daily flow occurred, from 1908 to 1919. There will also be found the mean daily flow of the period of four consecutive days of each year in which occurred the minimum mean flow of all such periods. These figures for flow were obtained by reducing the results of stream gaugings of the outlet at Alloway in proportion to the respective areas of the watersheds of the stream at Alloway and at the head of the outlet.

YEAR	1908	1909	1910	1911	1912	1913
Month of minimum flow.	Dec.	Oct.	Aug.	Sept.	Aug.	Sept.
Daily average of minimum mon.	34	47	37	37	62	24
Minimum 4-day period.	Sept. 7–10	Nov. 16–19	Aug. 2–5	Aug. 11–14	Aug. 21–5	Sept. 12–15
Daily average of minimum 4-d.	28	25	27	33	49	13

YEAR	1914	1915	1916	1917	1918	January to June 1919
Month of minimum flow.	Oct.	June	Oct.	Sept.	Sept.	Feb.
Daily average of minimum mon.	45	44	19	54	57	53
Minimum 4-day period.	Aug. 17-20	July 16–19	Oct. 3–6	Sept. 7–10	Aug. 30–Sept. 2	Feb. 10–13
Daily average of minimum 4-day	34	34	12	45	32	42

On July 23, 1920, measurements of the flow in the artificial outlet indicated a volume of approximately 40 cubic feet per second. In the absence of accurate measurements of sewage discharge, the water consumption of 1,000,000 gallons per day may be considered roughly as the rate of flow of sewage. With this flow of sewage it will be readily seen from the above figures that there will be insufficient dilution ordinarily and particularly at certain seasons to prevent a nuisance, a fact which is clearly confirmed by the observations made during the investigation and which will be referred to later.

Industrial Plants

1. The Lisk Manufacturing Company, manufacturers of enamel ware. This factory is located in the eastern part of the city and employs about 500 persons. The water consumption is approximately 50,000 gallons per day. All iron ware is pickled in an acid bath before being galvanized or enameled. The acid bath is a 0.5 per cent solution of sulphuric acid and is used until very weak, when the contents of the vats are discharged into the sewer. Seven vats are in use, and the period of use of each bath is about one week. It results that an average of at least one vat is drained per day. The spent acid is discharged directly into the sewer without provision for periodic distribution of concentrated wastes. From previous analyses it is known that the wastes from this plant contain considerable quantities of iron. It is claimed by an official of the company that subsequent to the investigation of the pollution of Canandaigua outlet, made in 1916, and in accordance with the recommendations of the report of that investigation, drain connections from the pickling vats were made with the city sanitary sewers allowing the wastes of their vats to pass directly into these sewers. It was found, however, that a quantity of liquid carrying light red particles in suspension flows in a ditch from a point on Ontario street opposite the Lisk plant to the outlet. The bed of this ditch is highly colored by the deposition of solids. Drainage enters this ditch at three points and appears to come from the Lisk plant.

It is possible that the acid of the wastes from this factory exerts a slight germicidal effect on the total quantity of sewage. On the other hand, the character of the waste is such as to hinder the bacterial activity upon which nitrification depends. Furthermore, some iron salts exert a reducing effect which tends toward the depletion of the supply of available oxygen and to the generation of hydrogen sulphide, with resulting offensive odors. It thus appears that the character of these wastes is such as to exert a deleterious effect on the process of natural and unoffensive purification of sewage by dilution.

2. Canandaigua Gas Light Company, manufacturers of illuminating gas. The gas manufacturing plant is located on Main street, near the head of the outlet. About 8 tons of coal are used per day. The byproducts are coke and coal tar. The gases driven off from the coal are passed through a water seal, where most of the coal tar and the various ammonia products are removed. The gases are then passed through various washers and scrubbers to further purify the gas for illumination purposes. It was stated by the superintendent of the plant that the water consumption ranged from 30,000

to 45,000 gallons per day. The ammoniacal gas liquors are discharged into an 8-inch sewer leading to a nearby manhole. A 6-inch sewer from the plant of the New York State Railways enters this manhole; thence the combined flow passes through a short section of 12-inch sewer into the city trunk sewer; thence directly into the outlet. This waste from the gas plant contains various nitrogen compounds and some coal tar. From results of tests in the gas plant at Providence, it is estimated that the Canandaigua plant produces 105 gallons of coal tar and 40 pounds of ammonia in the ammoniacal liquor per day. All of the ammonia and some coal tar which is not recovered are now discharged into the sewer and thence pass directly to the outlet. At the time of the investigation in 1916 the wastes of this plant and of the New York State Railways plant were passing through a ditch directly to the outlet. In accordance with the recommendations of the report on that investigation, these plants have been connected to the city sewer as described. The Gas company also distributes electric power. A portion of this power is developed at their hydro-electric plant at Littleville, but the greater part is generated at Rochester by the New York State Railways and is purchased from that company.

3. New York State Railways. This company maintains carbarns and a power station on property adjoining that of the Gas company. At present the power station is used only as a substation, stepping down by means of rotary converters the current transmitted from Rochester. There are two steam-driven generators installed, of 650 kilowatt capacity each. It is stated that these generators have not been used in a number of years. When weather permits, the cars are washed out of doors, the wash seeping into the ground or running off over the surface. In winter the cars are washed indoors, and the wash water passes through a drain into Canandaigua outlet. This wash water does not appear to constitute either a concentrated or objectionable type of waste. The wash room and toilet fixtures in the carbarns are connected with the city sewer, as described in the preceding paragraph.

In addition to the above industries, the Powell Corporation operates a vinegar plant, and the Cobb Preserving Company operates a preserving plant. A new plant for the manufacture of clothing is expected to commence operation in the near future. The sewage from none of these plants is in such quantity or of such a nature as to require special consideration.

General Condition of Outlet at Time of Inspection

The inspection in July followed a period of rain and moderately cold weather. The prevailing wind was from the south which resulted in a high turbidity of the water at the northern end of the lake and in the head of the outlet. The inspection in August occurred during a period of warm weather, high turbidity, and considerable rain.

The natural outlet of Canandaigua lake is provided at the point at which the water leaves the lake and passes under a concrete highway bridge, with a concrete spillway and flash boards. At the time of the investigation the flash boards were in place and a negligible quantity of water was flowing in this channel. Water entering the artificial channel passes under a masonry arch highway culvert. On the upstream side of this culvert horizontal timbers set against vertical timbers, the latter fastened to the masonry, form a submerged weir 9 feet 8 inches in length. About 300 feet below this culvert is an old low timber dam. The condenser intake of the gas company is located about 20 feet above the dam. The west side outfall sewer of the city is located about 100 feet below the dam. Notwithstanding the turbidity of the water, the sewage rising from the sewer outfall and flowing downstream could be readily seen. Below this upper outfall sewer, oil, greasy scum, and suspended solids presented abundant evidence of sewage pollution.

At the lower or east side outfall sewer of Canandaigua, the sewage could be seen as it mingled with the turbid water of the stream. Scum and suspended solids in augmented amounts were visible below this outfall. From this point to the point of confluence of the two channels the stream flows through agricultural land.

Below the junction of the two outlets of Canandaigua lake the stream flows through marshy land. At such points as obstructions occurred at the surface scum had collected. At the Pennsylvania railroad bridge the stream was carrying some suspended matter of such size as to be plainly visible. It was stated by a number of residents living between this point and Shortsville that at times conditions of the stream are extremely offensive; that solids which have been deposited on the stream bed become dislodged in large quantities, rise to the surface and float down stream in masses from 2 to 6 inches in diameter. At Chapin the flow is rapid above the bridge owning to the removal of the dam as previously described; below the bridge a good current exists. From Chapin to the pond at Littleville there is in general a good current, and few if any places in which sewage would tend to accumulate. There was in this section a considerable growth of grass and weeds in the stream. Near the east bank organic growths in the form of a green scum was found.

At the Littleville hydroelectric plant a boom was stretched across the flume. A quantity of greasy scum had collected above this boom. The water entering the flume was carrying scum. Accumulations of scum were lodged against the dam and east shore of the pond. Gas was rising through the water in the section of the flume extending from the racks to a point about 30 feet back of them. The operator at the hydroelectric plant stated that at times large quantities of floating solids lodge in the flume and above it and that at such times the odor is very offensive. In order to dispose of this floating matter it is necessary to open a gate in the side of the flume. He pointed out a quantity of this solid matter which had been sluiced out of the flume and had lodged in the dry portion of the stream bed below the dam. This deposit gave off a strong objectionable odor of undigested sewage sludge. A considerable quantity of scum had collected on the surface of the back water under the highway bridge a short distance below the dam and was in a putrefactive condition. The dam which impounded water at Littleville at the time of the previous investigation failed in 1917. It appears that the water thus released from the pond by the failure of the dam flooded certain buildings in Shortsville. It was stated by residents of that village that the receding waters left a large quantity of solids and sludge which was easily recognized as coming from sewage. From the preceding it appears evident that quantities of sewage solids are carried down as far as the Littleville pond, where some deposition occurs followed by putrefaction and the creation of objectionable conditions.

At Shortsville the outlet skirts the main part of the residential section but passes through the industrial section. At the upper end of the village a low dam diverts the flow of the stream into a raceway serving the Papec Machine Company and the Shortsville Paper Company. The dam is of timber construction and in such a condition that considerable leakage occurs. A diversion of the major portion of the water tends materially to decrease the current in the natural stream bed. A fairly large pond is formed in the industrial section by a second dam of concrete located near the street bridge. The water which enters the raceway above the upper dam is returned to the stream below the lower dam. At the time of the investigation the Papec Machine Company was discharging a considerable quantity of sewage and industrial wastes into this pond at two points. The discharge of untreated sewage and wastes into this poind under the conditions of low flow or of quiescence would tend to increase conditions of pollution and resulting nuisance at this point. The village health officer of Shortsville reported that at times conditions there are extremely offensive and that he believes a distinct nuisance is created.

Between Shortsville and Manchester the flow is in general fairly rapid, and it is improbable that any deposits of sewage sludge exist in this section. At the village of Manchester the area formerly flooded by a dam is now dry. The stream is confined to a channel of normal width and maintains a fair rate of flow through the village. From the village of Manchester to the settlement of Manchester Center the stream flows through agricultural land at a considerable distance from the highway. Through Manchester Center the flow is somewhat more sluggish owing to back water caused by the stones piled in the stream, the remains of an old dam. A short distance above the bridge which is located just north of Manchester Center some scum was seen lodged against a growth of weeds. From this point to a bridge ¾ of a mile southwest of Gypsum, a distance of about 2½ miles, the stream flows through an agricultural section but at a considerable distance from the highway. A short distance below the last mentioned bridge stones are piled across the stream, thus diverting the flow into a canal leading to the mill. Several accumulations of scum were found in this section. Below Gypsum the highway follows the general course of the stream the greater part of the distance to Phelps. A section of the stream about one mile long and beginning at a point about one mile below Gypsum has a low velocity. From this point to the upper end of the Upper Mill pond at Phelps, a distance of about 2½ miles, the velocity in general is good. Occasionally scum was found in this portion of the stream.

The outlet flows through the village of Phelps but is outside of the built-up portion. Two water powers have been developed in this section about half a mile apart. The upper dam, constructed of timber with masonry piers, abutments, and wing-walls, is in place, but the mill in which the power was used has recently been destroyed by fire. This dam backs water in two channels for a considerable distance. Below the dam the scum was seen in slack water.

At the lower dam, which is of concrete, hydraulic power is developed for use in a grist mill. At this point scum was found at the head-gates. Below the dam Flint creek discharges into the outlet. Considerable rain had occurred during the afternoon and evening preceding the investigation at this point, and the water in this brook was highly turbid and of a brownish color. The water in the outlet just above the point of confluence of the streams was fairly clear and such turbidity as it carried was of a grayish color.

Summary and Conclusions

As a result of this investigation, together with the results of previous investigations and data at hand, and after a careful consideration of the conditions of the stream above and below the points of pollution, and the volume of flow required properly to care for the quantity of sewage and other wastes discharged into Canandaigua outlet, at Canandaigua, the following summary and conclusions are presented:

1. That owing to the quantity of domestic sewage and trade wastes discharged into the outlet of Canandaigua lake from the city of Canandaigua, and to the comparatively low flow of water through the outlet during the summer and fall months, a public nuisance is created, which condition of nuisance would be intensified at times when the flow of the outlet is less than occurred during this investigation.

2. That the nuisance is largely due to the discharge into Canandaigua outlet of domestic sewage from the city of Canandaigua, and to a lesser extent to trade wastes from the plants of the Lisk Manufacturing Company and the Canandaigua Gas Light Company.

3. That due to the increasing quantity of sewage as indicated by the water consumption of the city of Canandaigua, the pollution of the waters of Canandaigua outlet therefrom is greater than at the time of the investigation of 1916.

4. That subsequent to the investigation of the pollution of Canandaigua outlet in 1916, and in partial accordance with the recommendations of the report on that investigation, drain connections were made with the city sanitary sewers permitting the discharge thereinto of a portion of the industrial wastes of the Lisk Manufacturing Company, but that a part of these wastes continues to flow through an open ditch to Canandaigua outlet into which it is discharged.

5. That subsequent to the investigation of the pollution of Canandaigua outlet in 1916, and in accordance with the recommendations of the report on that investigation, connections have been made with the city sanitary

sewers permitting the discharge thereinto of the sanitary sewage and industrial wastes of the Canandaigua Gas Light Company and the New York State Railways, and that these sanitary and industrial wastes are so discharged.

6. That the pollution of the waters of Canandaigua outlet is increased by the discharge into these waters of the sanitary sewage and industrial waste from the plant of the Papec Machine Company located at Shortsville.

Recommendations

In view of the above I would recommend:

1. That the city of Canandaigua be required to submit to this Department satisfactory plans for proper sewage disposal works designed to treat the entire sewage of the city before it is discharged into the outlet of Canandaigua lake. These plans should include treatment by both sedimentation and filtration, or methods equally satisfactory.
2. That after the approval by this Department of the above mentioned plans, the city of Canandaigua be required to construct the sedimentation tanks at the earliest possible date, and that permission be granted, upon application therefor by the city, for the deferment of construction of the filter until such time as the Commissioner of Health shall deem such construction necessary.
3. That the Lisk Manufacturing Company be required to make suitable drain and sewer connections and to discharge all of the sanitary sewage and industrial wastes from its plant at Canandaigua into the sanitary sewers of that city.
4. That provision be made by the city of Canandaigua for a more flexible and positive regulation of the flow of water from Canandaigua lake into its outlet than is now possible.
5. That the Papec Machine Company prepare and submit to this Department satisfactory plans showing details of construction and operation of a plant designed properly to treat its sanitary sewage and industrial wastes and upon the approval of same construct the plant in accordance therewith.

I would further recommend that copies of this report be sent to the Governor, boards of health of the towns of Manchester and Hopewell; the villages of Shortsville, Manchester, Clifton Springs, and Phelps; and the mayor and common council of the city of Canandaigua; to the sanitary supervisor of the district, the Lisk Manufacturing Company, and the Papec Machine Company.

Respectfully submitted

THEODORE HORTON

Chief Engineer

ALBANY, N. Y., *August* 19, 1920

Copies of this report were sent on August 20, 1920, to the Governor, to the sanitary supervisor, to the city authorities of Canandaigua, to two manufacturing plants discharging wastes into the stream, and to the complainants. On October 25, 1920. a notice of hearing and an order to show cause was sent to the city of Canandaigua. At the hearing held at Albany on November 9, 1920, it was stipulated that the city of Canandaigua was to submit plans to the State Department of Health by March 1, 1921, and to submit the bond proposition to the people of Canandaigua in June or July, 1921, and that the excavation and preliminary work be begun not later than August 1, 1921, and that the plant should be completed by July 1, 1922.

CHAUMONT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report upon an investigation of alleged insanitary and objectionable conditions created by the improper disposal of wastes from the Chaumont Milk station, near Chaumont, Jefferson county, N. Y. The investigation was made as a result of complaints received at this Department in regard to the pollution and the insanitary conditions caused by the discharge of wastes from the factory into Saw Mill bay. The factory and its surroundings were carefully inspected, and the methods of operation of the factory, the disposal of wastes therefrom, and the effects of their discharge upon Saw Mill bay were examined. The investigation was made on May 26, 1920, by Mr. A. I. Howd, assistant engineer in this Department, accompanied by Dr. O. J. Lafontaine, health officer of the village of Chaumont.

Chaumont is an incorporated village having a population of about 700, located in the west-central part of Jefferson county. It is on the Cape Vincent branch of the New York Central Railroad, about 14 miles from Watertown. The village is located on a peninsula which extends into Chaumont bay. The Chaumont river is on the northwest side of the village, and Horse creek on the southeast side. The soil in and surrounding the village is a clayey loam for a depth of about one foot which is underlain by fissured rock. In numerous places the rock outcrops at the surface of the ground. The village has no public water supply and no sewerage system.

The Chaumont Milk station is located outside the eastern village line, about 0.3 mile from Horse creek and Saw Mill bay. The factory, which is owned and operated by E. W. Coon, of 29 South Water street, Philadelphia, Penna., was established about 1910, but has been operated by the present owner only since June, 1919. It was formerly operated by the Bordens Farm Products Company, Inc., as a milk receiving and shipping station. The factory is now engaged in the manufacture of cheese, employing from 12 to 22 men. From 8,000 to 30,000 pounds of milk are received at the factory daily, depending on the season of the year; at the time of the inspection the maximum amount was being received. About 3,000 pounds of American cheese and 1,000 pounds of whey cheese, or "Ricotta" cheese, were being manufactured daily. The usual processes for the manufacture of the cheese are employed at the plant.

The water supply for the factory is obtained from Saw Mill bay, the intake being located a short distance from the point where the wastes from the factory enter the bay. The water is pumped into two elevated galvanized-iron tanks having a capacity of 900 gallons each, located at the factory. From these tanks the water flows by gravity through the plant. The amount of water used at the plant for all purposes may be roughly estimated at 5,000 gallons daily.

The factory is provided with a one-seat Kaustine chemical closet located adjacent to the factory. When the tank becomes full, the contents are carted away and buried.

In general, there are two classes of wastes to be disposed of from the factory. The first is whey, which amounts to about 2,000 to 2,500 gallons daily, a small portion of which is taken away by farmers. The second class of wastes consists principally of wash water from floors, cans, and apparatus, and contains slight quantities of milk, whey, curd, and other matter. The amount of water used for washing purposes was estimated to be about 2,000 gallons daily.

A portion of the whey is run through a 4-inch pipe to two circular wooden vats about 5 feet deep and 8 feet in diameter located outside the factory, from which it is taken away by the farmers. The remainder of the whey is run through a separate system of pipes and disposed of with the wash water. As a result of the vats either leaking or overflowing, the ground in the vicinity was in an insanitary condition and gave off offensive odors. The wash water and surplus whey are collected by floor drains and discharged through about 300 feet of 6-inch tile onto the ground near the railroad at an elevation of about 45 feet above the bay. The wastes flow in a circuitous course for several feet and then enter an opening in the ground, from which they apparently flow through crevices in the rocks and eventually enter a cove in Saw Mill bay seemingly unchanged in character. The course of the milky wastes could be noticed for several hundred feet in the water of the bay. Near their point of emission from the rocks and in the immediate vicinity stagnant pools of decomposing organic matter were observed which gave off offensive odors.

There are a number of houses located on a high bluff on the southeast side of the bay a short distance from the point where the wastes enter it. People interviewed stated that on warm days the odors arising from the cove and bay were very offensive. The bay is used to a considerable extent for boating and other pleasure purposes, which are affected by the discharge of the wastes into the bay.

The matter of wells becoming polluted by wastes from the cheese factory was brought to the attention of the engineer at the time of the inspection. One case in particular was investigated on a street several hundred feet south of the factory from the point of discharge of the wastes into the ground. A well 85 feet deep was drilled about four years ago and a gasoline pump installed, at a private residence. Extensive plumbing fixtures and piping were installed and the water was used for all domestic purposes including drinking. About June, 1919 (about the time manufacture of cheese was begun at the factory), the water acquired a peculiar taste and later had a noticeable whey odor. The odor of the water became so strong and disagreeable that it was impossible to use the water even for flushing the toilet fixtures. At the time of the inspection some water was pumped from the well and it was found to have a decided milky color and a noticeable whey odor. The engineer was also advised that other wells in the vicinity had become similarly affected.

The above conditions are apparently caused by the improper disposal of wastes from the cheese factory. Considerable quantities of whey and wash water are discharged into rock holes in the ground from which the wastes apparently flow through crevices in the rocks, polluting wells over 600 feet from their point of discharge into the ground and eventually entering a cove in the Saw Mill bay 0.3 mile from the factory, causing insanitary and offensive conditions. The discharge of wastes from this factory into Saw Mill bay and the ground waters tributary to it is a direct violation of the Public Health Law, since no permission has been granted to the owner of the factory to discharge wastes from the factory at Chaumont into the bay or the ground waters tributary to it. It would seem desirable therefore that he be advised to make immediate application to this Department for permission to discharge the wastes from the factory.

In view of the above facts it is evident that it will be necessary to provide some method other than that employed at present for the disposal of wastes from the factory. Whey contains such large quantities of decomposable organic matter that it is practically impossible to dispose of it by treatment in settling tanks and by discharging it into relatively small streams or small bodies of water. The whey might be discharged into tank wagons, carted away and distributed over farm land; or since the country east of the factory is sparsely populated, arrangements might be made whereby the whey might be pumped onto some farm land about a half mile distant, which would serve the double purpose both of disposing of the whey and also enriching the soil. On the other hand, it might be possible for the owners of the factory either to require or pay the farmers to take all the whey away.

The waste water and washings consist principally of water and contain small amounts of milk, whey, curd, and other matter. In cases where a body of water or stream flow is large enough to provide ample dilution, treatment of the waste water and washings in a settling tank may be sufficient. When the volume of flow in a stream or a body of water is not large enough or there is not sufficient circulation of the water properly to dilute the effluent from the settling tank treating the waste water and washings, it is necessary that supplementary works for more complete treatment of these wastes be provided, such as some form of filter; or where soil conditions are favorable, the construction of cesspools to receive and dispose of the effluent from the settling tanks.

At Chaumont the soil conditions are not favorable for the disposal of the waste water and washings in leaching cesspools. Furthermore, owing to the character of the ground it would not be safe to discharge into the ground waters near this plant any effluent but a properly settled, filtered, and sterilized effluent. A more economical method of disposing of the waste water and washings than sedimentation, filtration, and sterilization might be afforded by treatment of the wastes in a settling tank and by discharging the effluent through a pipe line into Horse creek, about one-half mile northwest of the plant. This creek has a drainage area of about 17 square miles, and should provide proper dilution for the effluent from a settling tank to treat the waste water and washings. If it should be found after a reasonable time that the volume of flow in the stream is not sufficient properly to dilute the effluent, it would be necessary to provide supplementary works for more complete treatment of the wastes. On the other hand, the wastes might be collected and pumped back onto farm land, together with the whey. If the owner of the factory decides that some method of treatment of the wastes is the most feasible method of disposing of the wastes, plans of the proposed method of treatment should be submitted to this Department for approval.

As a result of this inspection I conclude that the insanitary conditions complained of are caused by the conditions mentioned above and I therefore recommend:

1. That the ground in the vicinity of the whey vats be put in a more sanitary condition.
2. That the owner of the Chaumont Milk Station at Chaumont be required to provide some proper and sanitary method for disposing of the wastes from the factory other than the present method of discharging them into crevices in the ground and Saw Mill bay.
3. That unless immediate action is taken by the owner of the factory to discontinue the pollution of Saw Mill bay and the ground waters tributary to it, action be taken by you under section 76 of the Public Health Law to cause the discontinuance of the pollution of these waters.

I further recommend that copies of this report be sent to the local board of health, to the sanitary supervisor of the district, to the complainants, and to the owner of the cheese factory at Chaumont.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *June* 29, 1920

Copies of this report were sent on June 29, 1920, to the local board of health, to the sanitary supervisor, to the complainants, and to E. W. Coon, owner of the factory. Plans for the treatment and disposal of wastes from the factory were submitted to this Department for approval August 17, 1920, and September 10, 1920, both sets of plans being disapproved since they were not in satisfactory condition for approval.

HOBART

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report upon an investigation of the objectionable conditions created by the discharge of creamery wastes into the West branch of the Delaware river at Hobart, which was made the subject of a complaint to this Department by the local board of health through the sanitary supervisor. The investigation was made by Mr. W. J. Erickson, sanitary inspector, on July 1, 1920, accompanied by Mr. B. L. Springs, president of the village.

Hobart, which is an incorporated village of about 600 inhabitants, is located in the northeastern part of Delaware county, and on the West branch of the Delaware river, about 4 miles southwest of Stamford, on the Ulster and Delaware railroad. Hobart receives its water supply from Town brook and Grant brook, east of the village. From the intake dam the supply passes through a slow sand filter before it is delivered to the consumers.

The plant of the Sheffield Farms Company, Inc., of which Mr. B. J. Young is superintendent, and the plant of the Sheffield By-Products Company, of which Mr. F. L. Chappell is superintendent, are located close together in the northeastern part of the village, on the Ulster and Delaware railroad, and about 75 feet from the West branch of the Delaware river. These plants were built about 35 years ago, but since then several alterations and additions have been made to them. The average number of employees at the plants is 45, but at times it reaches as high as 60 in the summer months. The product manufactured at the Sheffield Farms Company plants is butter. Some cream is also shipped. At the Sheffield By-Products plant, casein, milk sugar, and albumen are made. An addition to the latter plant is contemplated in which milk powder is to be made.

The water supply, which is derived from the companies' own wells, is pumped to an elevated tank and thence flows by gravity to the plants. The cooling water is obtained from a pond outside the building.

Between 1,000 and 1,500 cans, holding 40 quarts of milk each, are received on the average per day, but on the day of the inspection only 500 cans of milk and 300 cans of skimmed milk were received. The milk is pasteurized and skimmed. The cream is churned into butter and the skimmed milk is delivered to the By-Products Company. On the average, about 8,000 pounds of butter are produced in a day. The buttermilk is pumped into a tank and sold to the farmers. The skimmed milk is poured into the casein vats at the By-Products plant, diluted hydrochloric added, and allowed to ferment. When this process is completed the whey is drawn off and used in the manufacture of milk sugar. The casein remaining in the vat is then washed, dried, ground and barreled. The whey is boiled in vacuum pans, and the resulting syrup allowed to stand for a day in wooden vats. It is then washed, refined, dried, ground, and barreled. Unrefined sugar from other plants is also sent here for refining. About 2,500 pounds of sugar are produced in a day.

It was stated by Mr. B. I. Sheffield, district manager, that the total amount of wastes was about 40,000 gallons a day. These are principally wastes from the washing of milk cans and other apparatus, from the washing of the butter, casein, and sugar. These wastes, especially those from the washing of the casein, contain considerable organic matter. They are generally discharged into the village sewer and passed through the village disposal plant. About the first of June, however, the sewer from the creamery became clogged, and for a period of a few days the wastes were discharged directly into the river. This gave rise to the conditions complained of.

Our inspector conferred with Mr. B. L. Springs, member of the board of trustees of the village of Hobart, who stated that about this time the stream bed became exceptionally bad and that it gave off a very disagreeable odor. The stream bed, it was stated, was covered with a heavy slimy growth which usually results from the discharge of such wastes. It was stated that these conditions had since improved, and that the rains falling during the previous two weeks had washed most of the growth away. At the time of the investigation a slight odor of decomposing organic matter was noticed just below the mill dam, and the woodwork of the dam and the bottom of the stream in the shallow places were covered with the fungus referred to. Opposite the creamery there were no organic deposits noticed, and the only discharge from the creamery consisted of the clear water from the condensers.

The cheese factory of the Cohen Dairy Company, Inc., was also visited. This plant is located about 2 miles northeast of Hobart, on the north bank of the West branch of the Delaware river. This plant has a settling tank in which only wash water is disposed of. The whey and other milky refuse is conducted into a concrete tank and disposed of by the farmers. There was only a slight discoloration at the outlet of the settling tank, but 25 feet of the stream was as clear as above the outlet. The plant appeared to be working efficiently at the time of the inspection and no complaint has been made against it.

The disposal plant of the village of Hobart was also inspected. This plant is located about three-quarters of a mile west of the center of the village. The nearest dwelling is about 1,000 feet distant. The plans for this plant were approved by this Department on November 28, 1911, and the plant was built substantially according to the approved plans. It consists of two sedimentation tanks, dosing tanks, and six intermittent sand filters. The sedimentation tanks are about 11 feet by 20 feet, with a capacity of about 12,800 gallons each, and with the present estimated flow of 100,000 gallons will give about 6 hours detention. Both of the tanks were in operation at the time of the inspection. The surface of the tank was covered with a heavy layer of scum at the time of the inspection. The dosing tanks are connected with the sedimentation tank and have a capacity of about 1,000 gallons. The total content of each dosing tank is discharged through a 6-inch siphon onto the sand filters. Only two beds were receiving sewage at the time of the inspection, two were resting, and two were drying preparatory to being cleaned. The two beds that were being dosed and the two that were resting were covered to a depth of from a few inches to about 1 foot with sewage.

It appeared from the inspection that the operation of the plant was seriously interfered with, and the filters were overtaxed by the large amount of creamery wastes which amount to about 40,000 gallons or about one-quarter of the total amount.

The beds were apparently clogged and were not operating efficiently. There is a man continuously at the plant, but the overtaxing of the plant by the trade wastes make it almost impossible efficiently to operate the plant. Although the plant could probably care for a relatively small amount of creamery wastes in addition to the present flow of domestic sewage, it is inadequate properly to care for the present large combined flow of domestic sewage and creamery wastes.

The watershed at the outlet of the disposal plant is about 32 square miles in area, and consists mostly of wooded hilly and partly open and cultivated low lands. The river above receives the effluent from the Stamford disposal plant. Below the outlet the river is not used for a public water supply in this State. A slight milky color was noticed issuing from the outlet pipe of the Hobart disposal plant, and the bottom of the stream was colored white for a considerable distance by the same effluent. No disagreeable odor was noticed, however, at the time of the investigation, but it was stated by people living near the outlet that the odor at times was very nauseating, especially in warm weather.

In the report of this Department for the year 1914, on an inspection of the disposal plant of the village of Hobart, it was pointed out that the operation of the plant was seriously interfered with by the discharge of creamery wastes into the village sewer system and the disposal plant. The creameries referred to were at that time employing a firm of consulting engineers to design a disposal plant, and the firm had been advised that consideration would be given to the issuance of a permit to discharge effluent directly into the river from a plant to treat the wastes from these two factories. Mr. Sheffield stated that nothing further has been done toward installing a disposal plant. However, the condensing and cooling water have been separated from the wash water and is now being emptied into the river direct.

The report on the investigation in 1914 contained the following recommendations:

Inverted Siphon, West Main street:

1. That the chamber be provided with a tight cover to prevent the escape of odors.
2. That the chamber be cleaned out and the siphon be put in operating condition.
3. That the siphon pipe be made tight so that the sewage will reach the disposal works.

Settling Tanks:

1. That all sludge and scum be removed from the tanks and buried in trenches or otherwise disposed of so as not to cause a nuisance. Burying is recommended on account of the odors, the presence of fly larvae, and the ability of the sludge to retain moisture which prevents its drying up.

2. That both tanks be used continuously while the sludge and scum be removed at frequent intervals so as to keep the plant in a fresh condition.

Dosing Tanks:

That the automatic siphons be overhauled and put in working condition and that the total capacity of the dosing tanks be discharged at one time with the siphons working alternately.

Sand Filters:

1. That all sludge be removed from the surface of the bed and buried.

2. That embankments around the beds be replaced with sand of the same size as that used for the beds so that starting at the top of the slope and descending the slope there will be at each point a vertical depth of 3 feet of the sand, or that some other method be used which will make the embankments equally impervious to the sewage.

3. That the gate manhole between the four sand filters be divided so that each siphon can discharge to any of these beds, and that effluent from the dosing tanks be discharged alternately by the two siphons onto not less than two beds at each discharge of a siphon.

4. That whenever a bed shows a tendency to hold the sewage on the surface too long, it should be put out of service long enough to allow the scum to dry and be removed.

5. That the beds and grounds be kept in a clean and fresh condition.

6. That sufficient labor be employed to maintain the disposal works in proper condition.

From the above considerations the following conclusions may be drawn:

1. That all of the recommendations of the report of 1914 have not been carried out.

2. That the unsatisfactory conditions of the stream flowing through the village complained of was largely due to the discharge of creamery wastes directly into the stream above the village at the time the sewer from the creamery was clogged.

3. That the village disposal plant was being overtaxed by the addition of about 40,000 gallons of creamery wastes. The plant was designed to take care of only a small amount of creamery wastes in addition to the domestic sewage of the village.

In view of the fact that the village disposal plant is overtaxed beyond the amount for which it was designed, I would recommend:

1. That the village of Hobart either provide for enlarging the present sewage disposal plant sufficiently to care properly for all of the domestic sewage and creamery or trade wastes tributary to the existing sewer system and sewage disposal plant, or, that the Sheffield Farms Company, Inc., and the Sheffield By-Products Company be required to disconnect from the village sewerage system and provide for an independent sewage disposal plant for the complete treatment of their wastes by sedimentation and filtration before the discharge of these wastes into the West branch of the Delaware river.

2. That in either case, plans be submitted to this Department for approval in duplicate for the proposed enlargement of the village sewage disposal plant or for an independent disposal plant for the plants of the Sheffield Farms Company, Inc., and the Sheffield By-Products Company.

3. That the village carry out the recommendations of our previous report with respect to the operation and maintenance of the village disposal plant.

I would further recommend that copies of this report be sent to the local board of health, to the sanitary supervisor, and to the Sheffield Farms Company, Inc., and the Sheffield By-Products Company.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *August* 18, 1920

Copies of this report were sent on August 20, 1920, to the local board of health, to the sanitary supervisor, to the village authorities, and to the Sheffield Farms Company, Inc., and the Sheffield By-Products Company.

SCHROEPPEL (Town) Pennellville

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report upon an investigation of alleged insanitary and objectionable conditions created by the discharge of wastes from the milk station and creamery of the Beakes Dairy, Inc., at Pennellville, Oswego county, N. Y., into a tile drain and thence into Potts creek, which condition was made the subject of complaint to this Department. The inspection was made by Mr. N. H. Baier, sanitary inspector in this Department, on August 24, 1920, accompanied by Dr. B. W. Severance, health officer of the town of Schroeppel.

The plant, its operation, the method of disposal of its wastes, the creek into which the wastes discharge and the surroundings were inspected. Mr. H. D. Downs, manager of the plant, and nearby residents were interviewed.

Pennellville is an unincorporated village of some 350 inhabitants, located in the southern part of Oswego county, on the New York, Ontario and Western railroad, 20 miles southeast of Oswego. The village has no public water supply or sewerage system.

The Beakes Dairy, Inc., has its main office at 206 East 12th street, New York city. It was established some 25 years ago and has been under the present ownership since 1905. The Pennellville plant was a milk shipping station up to last April, when the manufacture of cheese was begun. Some cheese has, however, been made in previous years. At present about 8,000 pounds of milk are received daily, from which about 700 pounds of Italian cream cheese and 130 pounds of whey cheese are made. There are 7 men employed throughout the entire year. The water supply is obtained from a driven well located within the plant.

There are two kinds of wastes to be disposed of from the plant, *i. e.*, whey, of which there are about 600 gallons daily, and wash water of the floors and cans, of which there are 150 gallons daily. Both the whey and the wash water are discharged directly into a drain in the floor which connects with an 8-inch tile sewer. The latter is laid underground and just northeast of the New York, Ontario and Western railroad. There are about 800 feet of sewer, then 40 feet of open ditch, to the water's edge of Potts creek.

Potts creek rises at a point 6½ miles north, and continues for 3 miles south of Pennellville to the Oneida river. The greater part of the course of the creek is through swampy land. The drainage area above Pennellville is about 13 square miles. The creek has been dammed up at Pennellville for sawmill purposes, giving rise to a large pond whose greatest width is 300 feet and which was 2 to 3 feet deep at the time of the inspection. The water has practically no current during the summer months for a distance of about three-fourths of a mile above the dam. Below the dam there is a good flow at the center of the creek, the bed of the rest of the creek having become filled with a heavy silt. A short time ago the owner of the sawmill used about 10 pounds of dynamite to make the present small channel-way at the center.

The point of discharge of the wastes of the Beakes Dairy is about 400 feet above the dam. There were numerous patches of white scum not only near the point of discharge but throughout the entire pond. This, together with some black, septic material and numerous leaves and twigs, gave to the pond a very unsightly and insanitary appearance. The point of discharge of the wastes of the Rosemary Creamery Company, also of Pennellville, N. Y., is 100 feet above the dam. At the time of the inspection the Rosemary Creamery was not in operation and had not been since early this spring, so that the effect on the pond of the discharge of wastes from this creamery could not be ascertained. Inspection also showed that the sanitary sewage of one, and at times, two houses, passes into a ditch, overgrown with grass, which discharges into the pond not far from the outlet of the Rosemary Creamery Company. The odors of sanitary sewage and creamery wastes were detected when crossing the highway leading across the dam.

The discharge of wastes from the plant of the Beakes Dairy, Inc., into Potts creek, which eventually discharges into the Oneida river, is a violation of the Public Health Law, since no permission has been granted and no plans approved foi the treatment and discharge of wastes into the stream. The Beakes Dairy, Inc., should be notified of such violation and be requested to make application for a permit to discharge wastes into the stream.

Since the Beakes Dairy, Inc., manufactures whey cheese from the whey, so that the resulting grayish-white whey waste water has very little organic matter, it appears to this Department that the waste whey and wash water could probably be satisfactorily disposed of into Potts creek at some point below the dam, provided these wastes are first passed through a settling tank having a capacity equal to one day's flow of wastes. The ditch at the present outlet should be thoroughly cleaned of its organic matter. Application should be made to this Department by the Beakes Dairy, Inc., for permission to discharge the wastes from their plant into Potts creek, in accordance with the requirements of the Public Health Law. This application should contain or be accompanied by a plan or sketch showing the relative location of the factory and settling tank to the nearest highway, stream, and railroad, existing and proposed sewers, with size and grade, together with approximate distances and dimensions.

In view of the above facts, the following conclusions may be drawn:

1. That the discharge of wastes from the Beakes Dairy, Inc., into Potts creek without a permit from this Department is a violation of the Public Health Law.
2. That the pond above the dam is in an insanitary condition due to the discharge of creamery wastes into it.
3. That due to the stagnant condition of the pond of Potts creek above the dam during the summer months, considerable odor may result through the discharge of such wastes and give rise to a nuisance.
4. That the bed of the creek below the dam is filled with silt which hinders the flow and rapid removal of the water.

As a result of this inspection and in view of the foregoing, I would make the following recommendations:

1. That the Beakes Dairy, Inc., be notified of its violations of the Public Health Law by the discharge of wastes into the waters of the State.
2. That the wastes from the Beakes Dairy, Inc., be passed through a settling tank and the effluent from such tank be discharged into Potts creek through a water-tight sewer line below the dam instead of above as at present.
3. That the Beakes Dairy, Inc., make application to this Department for the disposal of its wastes, such application to be accompanied by a plan or sketch showing the relative location of the factory and settling tank to the nearest highway, stream, and railroad, existing and proposed sewers, with size and grade, together with approximate distances and dimensions.
4. That the Beakes Dairy, Inc., thoroughly clean the ditch between the present sewer outlet and the point of discharge at Potts creek.

I would further recommend that copies of this report be sent to the Beakes Dairy, Inc., to Dr. B. W. Severance, health officer of the town of Schroeppel, to Dr. C. R. Hervey, sanitary supervisor of the district, and to the complainant.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *September* 2, 1920

Copies of this report were sent on September 9, 1920, to the local board of health, to the sanitary supervisor, to the complainant, and to the Beakes Dairy, Inc.

In addition to the above, inspections were made and reports transmitted to the local authorities, or advice given through correspondence, in cases of stream pollution at the following places: Arkville, Cedarville, DeRuyter, Easthampton, Jefferson, Jordanville, Liberty (town), Lisha Kill, Naples, New Baltimore (town), New Berlin, Niagara River, North Tonawanda, Port Chester, Watervliet, and Wayland.

INVESTIGATION OF PUBLIC NUISANCES NOT ARISING FROM STREAM POLLUTION

INVESTIGATION OF PUBLIC NUISANCES NOT ARISING FROM STREAM POLLUTION

The Public Health Law definitely places the abatement of public nuisances within the jurisdiction of local boards of health, and chapter VI of the State Sanitary Code, established by the Public Health Council, clearly defines and specifies the procedure to be followed in such cases. However, public nuisances often have a widespread effect or may require in their adjustment special knowledge of a technical nature.

The assistance of the State Department of Health is therefore often requested in such cases, and in some instances direct complaint is made to it by persons concerned. Whenever it is necessary for a proper understanding of the case, a thorough investigation is made of the conditions, upon which are based recommendations and advice to the local boards of health in regard to the proper steps to be taken to abate the conditions of nuisance. In other cases it is possible to show the proper course through correspondence alone.

The reports of the more important cases which have come before the Department of Health during 1920 are given below, and a list of other cases is appended.

CLAYTON

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report upon an investigation of alleged conditions of nuisance caused by the emission of smoke from the pumping station of the Clayton waterworks and from the Thousand Island Laundry, in the village of Clayton, made as a result of a complaint and petition signed by some 32 residents of Clayton, submitted to this Department by the local health officer at the request of the complainants. Briefly stated, the substance of the complaint is that the people living in the vicinity of the pumping station and the laundry are unable to open their windows for ventilation, except when there is a south wind, and that the smoke and soot from these establishments make it necessary for the people to rewash their clothes frequently.

The investigation was made on November 21, 1919, by Mr. A. I. Howd, inspecting engineer in this Department, in company with Dr. H. J. Frame, health officer of the village of Clayton. The pumping station, the laundry, and their surroundings were carefully investigated. Several complainants were interviewed with reference to the alleged nuisance.

The incorporated village of Clayton, which has a population of approximately 1,900, is located in the northwestern part of Jefferson county, in the town of Clayton. It is the western terminal of the Philadelphia and

Clayton branch of the New York Central railroad. The pumping station and the Thousand Island Laundry are located on Water street, in the northern part of the village, in a closely built-up residential and business section.

The pumping station of the Clayton waterworks is owned by the village of Clayton, of which Mr. M. A. Marble is president. The public water supply is derived from the St. Lawrence river, subjected to sterilization with liquid chlorine, and pumped directly into the mains. The pumps are operated approximately 7 hours daily. In addition to the pumps, the equipment of the station includes one Babcock and Wilcox 75-h.p. water tube boiler, having a grate area of 19½ square feet, and a 100-h.p. horizontal tubular boiler manufactured by the Gem City Boiler Company, having a firebox 5½ feet by 6 feet. A 32-inch stack rises to a height of about 30 feet above the roof of the building, or about 65 feet above the elevation of the ground. Coal is fed onto the fire manually at intervals of 15 to 30 minutes. About 1 ton of bituminous coal is used daily.

The following observations were made with reference to the emission of smoke from the plant: When coal was thrown on the fire a dense black smoke issued from the stack, which gradually decreased in intensity to a light smoke which became nearly invisible in about 20 minutes. A strong south wind was blowing at the time of the inspection, which carried the smoke out over the river in the opposite direction from the complainants' properties, and apparently for a distance of 1,000 feet or more before it became sufficiently dispersed and diluted to be invisible. If the wind had been blowing in the other direction, the smoke would undoubtedly have created conditions of public nuisance.

The Thousand Island Laundry, of which Mr. T. E. Flynn is owner, has been at its present location for over 5 years, engaged in complete laundry work, including washing, drying, and ironing. At the time of the inspection there were 3 employees and the plant was being operated 4 days per week. During the three summer months the laundry is operated daily for 9 hours per day and employs from 10 to 14 people.

The plant is equipped with a horizontal tubular boiler having a 36-inch by 36-inch grate, manufactured by James Leffell and Company, Springfield, O. A 15-inch stack rises to a height of 25 feet above the top of the boiler, or 35 feet to 40 feet above the ground. Bituminous coal is fed onto the fire manually at intervals of 15 to 45 minutes. About 1 ton of coal is used per week during the winter. Mr. Flynn stated that prior to a year ago he had used hard coal for firing purposes, but owing to the large increase in cost of hard coal it became necessary for him to use soft coal. When coal was thrown on the fire a dense smoke issued from the stack, which gradually decreased in intensity for 10 to 15 minutes when it became practically invisible. At the time of the inspection the wind was blowing the smoke out over the river from the complainants' properties. If the wind had been blowing from the opposite direction, it is probable that objectionable conditions would have been created affecting a considerable number of people.

As noted above, the pumping station and laundry are located on Water street, in a closely built-up business and residential section of the village. More than a score of houses within 500 feet to 1,000 feet of the plants may be directly affected by the objectionable conditions.

It was alleged by the complainants who were interviewed that when the wind blows in the direction of their houses it is necessary for them to keep the windows of their houses closed owing to the large volumes of smoke; that the smoke and soot get on their houses and porches; and that the conditions created by the operations of these plants impair their health.

Our engineer was informed at the time of the inspection that there are other plants in the village which burn soft coal. It would seem advisable therefore for the village authorities to enact a smoke ordinance to cover all cases in the village.

As a result of this investigation the following conclusions may be drawn:

1. That the use of soft coal for firing purposes at the Clayton waterworks pumping station and at the Thousand Island Laundry under the present methods and conditions causes smoke and soot to escape into the atmosphere in such quantities as to create conditions of public nuisance.
2. That there are other plants in the village of Clayton burning soft coal which were not included or mentioned in the original complaint to this Department.

I therefore recommend:

1. That the village authorities of Clayton be advised to take immediate action to prevent the escape of smoke and soot from the village waterworks pumping station and from the Thousand Island Laundry into the atmosphere in such quantities or in such a manner as to create a public nuisance.
2. That in order to cover all plants or buildings discharging large quantities of smoke into the atmosphere, the village authorities be advised to enact a smoke ordinance, limiting the amount and density of smoke issuing from plants and buildings in the village.

I also recommend that copies of this report be sent to the local board of health, to the sanitary supervisor of the district, to the village authorities, and to the Thousand Island Laundry.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *January* 16, 1920

In accordance with the above recommendations, copies of this report were sent on January 16, 1920, to the local board of health, to the sanitary supervisor, to the village authorities and to the Thousand Island Laundry.

NEWARK (Commonwealth Chemical Corporation)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on a reinspection of the plant of the Commonwealth Chemical Corporation at Newark, made at your direction and as the result of further complaint of the objectionable conditions caused by the emanation of odors from the chemical works of this company.

The inspection was made by Mr. C. A. Holmquist, principal assistant engineer of this Department, in company with Dr. H. A. Wiedrich, acting health officer of the village, and Mr. K. V. Stockelbach, manager of the chemical works, on April 9, 1920. The institution authorities and a number of residents living in the vicinity of the plant were also interviewed. Previous inspections of this plant were made by representatives of this Department, as the result of complaints from the village, on July 16, 1917; September 16, 1917; January 25, 1918; August 3, 1918; and September 25, 1918. The findings and results of these inspections are covered in reports and memoranda which have been prepared and transmitted and will therefore not be reviewed at this time.

As noted in a previous report, the chemical works of this company, which has been in operation since November, 1916, is located in a developed section of the village, immediately west of the Newark State School, formerly the Newark State Custodial Asylum. The hospital and the infirmary of this institution is within 500 feet of the plant, and most of the other buildings, including the residences of the superintendent and the steward, are within from 1,000 to 1,500 feet of the works.

The principal products of the works at this time are benzoic acid, benzoate of soda, benzaldehyde, and coumarin. Toluol, chlorine gas, hydrochloric acid, sulphuric acid, lime, glacial acetic acid, powdered aldehyde, and bicarbonate of soda are the principal chemicals used in their manufacture. Benzol alcohol, malachite green, and iraline were formerly produced, but the making of these products has now been discontinued. The daily output of the works has increased greatly since 1916, and the production of benzoic acid and benzaldehyde, which are the main products, has been increased nearly fourfold since the time of the last inspection in 1918. Whereas only a few men were employed when the plant was first put in operation, from 60 to 70 men are now employed at the works.

It would be impracticable in this report to describe in detail the processes of manufacture of the chemicals produced at present. It might be stated briefly, however, that the principal steps or processes carried out consist of the chlorination of the toluol, distillation, sublimation, boiling, and mixing of the various ingredients and compounds. Whereas odors, gases and vapors, or fumes, are given off from a number of points in the works and from a number of stages in the process of manufacture, the principal odors and gases emanating from the works are from the manufacturing of benzoic acid and benzaldehyde, and consist of odors of bitter almond oil, odors of benzoic acid or dust, and hydrochloric acid, and chlorine gases. Although the bitter almond oil odors permeate the entire works and are strong and pronounced in the plant, and could be distinctly observed and identified at a considerable distance from the works, the hydrochloric acid and chlorine gases were much more objectionable, and produced coughing and an irritating sensation in the throat in and near the works.

A number of devices for the absorption and elimination of these latter gases have been installed and tried out since the works were put in operation. The earlier devices, however, failed to care for these gases due largely to their inadequacy and to the difficulties experienced in disposal of the liquid wastes from the absorption and scrubbing towers. Finally a scrubbing and absorption device consisting of a set of two tourills and a scrubbing tower 3 feet in diameter and 10 feet high designed to operate in series was installed in the summer of 1918. This device seemed to operate satisfactorily, and almost entirely eliminated the escape of hydrochloric acid and chlorine gases when under observation at the time of the previous inspection on September 25, 1918. It appears, however, that the production of benzoic acid and benzaldehyde has increased to such an extent that the amount of hydrochloric acid and chlorine gases liberated in the process of manufacturing greatly exceeded the capacity of this absorption and scrubbing device, and the use of this particular arrangement was abandoned. The company has now installed 11 absorption and scrubbing devices, one for each of the 11 toluol chlorination units. Each of these devices consists of two tourills operated in series. The first tourill is filled with water and the second with earthenware blocks. The gases generated by the chlorination of toluol are passed through the first tourill where most of the hydrochloric acid gas and probably some of the chlorine gas is absorbed by the water. The unabsorbed gases are then passed from the second tourill down through which a stream of water flows for the purpose of absorbing and scrubbing the residual gases. After a certain amount of hydrochloric acid has been absorbed by the water in the first tourill, the resulting solution of the hydrochloric acid is drawn off and used at the works in the process of manufacturing and fresh water is added. The water used in the second tourill is allowed to run to waste to the sewer.

Although the same general principles were embodied in the design of these scrubbing and absorption devices as those used in the scrubber that appeared to operate satisfactorily in 1918, the present devices are defective in many respects and not as effective, and relatively large volumes of hydrochloric acid and chlorine gases were found escaping through leaky joints and connections, from the waste scrubber water, and from the solution of hot hydrochloric acid when drawn from the first tourill at each absorption unit. It is probable also that considerable volumes of gases occasionally escape in the case of breaks in the scrubbers.

It was learned from the manager of the works that material has been ordered for the installation of a number of absorption and scrubbing devices like those in successful operation in 1918, and that it was expected to have these new devices installed and in operation by June 1 of this year. Changes are also being made in the process of making benzoic acid and benzaldehyde which will prevent the escape of benzoic acid into the atmosphere when the hydrochloric acid is added to the tubs of calcium benzoate in the yard of the works, and from the ventilator over the wooden vat where the benzoic acid is melted. Although the odors or dust of benzoic acid were strong in the works near the tubs and vat, they did not appear to carry any considerable distance at the time of the inspection. Odors of acetic acid were also observed in the portions of the works where coumarin is made, but this odor could not be observed outside the premises of the works.

It was claimed by the persons interviewed in the village that the benzaldehyde or bitter almond oil odor could be observed whenever the wind was from the direction of the chemical works, and that occasionally there was an odor of gas from the works that produced coughing and an irritating sensation in the throat. It was also alleged that these odors are sometimes accompanied by a fog-like appearance of the atmosphere. These conditions are probably produced by the escape of hydrochloric acid and chlorine gases from the works.

In conclusion, I would state that it was found from the recent inspection that the production of chemicals at the Newark works of the Commonwealth Chemical Corporation has increased greatly since the time of the last inspection in 1918, and that the installation of scrubbers and absorption devices for preventing the escape of odors and gases of the works has not kept pace with the growth of the works. The existing devices for the absorption and scrubbing of hydrochloric acid and chlorine gases escaping from chlorinating toluol are not efficient nor do they effectively prevent the escape of these gases into the atmosphere. Furthermore, no effective steps have been taken to prevent the escape of bitter almond oil odor and the acetic acid odor. The result of the escape of gases, dust, and odors from the various portions of the chemical works produces a serious public nuisance which affects not only the Newark State School located in close proximity to the works but also a large portion of the village in the neighborhood. It was found, however, that modifications in construction and operation were in progress which would probably in large measures prevent or at least reduce the escape of benzoic acid into the atmosphere. Furthermore, material had been ordered for the installation of more effective absorption and scrubbing devices designed to prevent the escape of hydrochloric acid and chlorine gases, and it is probable that these devices will reduce, if not wholly eliminate, the escape of these objectionable gases from the works. Steps should also be taken by the company to reduce or prevent as far as possible the escape of benzaldehyde or bitter almond oil odors and the acetic acid odors or gases from the works possibly by the installation of a system of hoods and scrubbers and by more careful operation.

In view of the above and after careful consideration of the matter, I would make the following recommendations:

1. That the Commonwealth Chemical Corporation be notified to take immediate steps effectively to eliminate the escape of odors and gases from its chemical works at Newark.
2. That if the public nuisance now created by the escape of odors and gases from the chemical works is not effectively abated within a reasonable length of time, action be taken by you to have the nuisance abated in accordance with the provisions of the Public Health Law.

I would further recommend that copies of this report be transmitted to the Commonwealth Chemical Corporation and to the local board of health.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *April* 13, 1920

In accordance with the above recommendations, copies of this report were sent on April 20, 1920, to the local board of health and to the Commonwealth Chemical Corporation.

On November 11, 1920, further complaint was made regarding conditions of nuisance created by the operation of the factory and on November 17, 1920, a reinspection of the plant was made. Certain improvements had been made to reduce the amount of odors escaping from the plant, but due to improper operation fumes and gases escaped from the factory at times in considerable quantities.

OSSINING

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the objectionable conditions created by the maintenance of a refuse dump in the village of Ossining, which was made the subject of a complaint to this Department. The investigation was made on November 16, 1920, by Mr. A. I. Howd, assistant engineer in this Department, accompanied by Dr. Robert T. Irvine, health officer of the village of Ossining. People living in the vicinity of the dump were interviewed, and the dump and its surroundings were carefully inspected.

The garbage and refuse in Ossining is collected by contract for the village. The contractor, Mr. Luke F. Lyons, had one wagon having a capacity of 2 to 3 yards, and an auto truck having a capacity of about 2 yards, which were used in making collections of ashes and rubbish through the village. No restriction is made by the village, according to the local health ordinances, in regard to the kind of receptacles to be used for the receiving of garbage and refuse except that they shall hold the matter "without leakage." The garbage is collected separately, and the ashes and rubbish are collected combined. The garbage is taken outside the village and disposed of, while the ashes and rubbish are dumped at sites in the village approved by the local board of health.

The dump which was made the subject of the complaint to this Department is located in the southern part of the village adjacent to Washington and South Highland avenues. This site was chosen with the permission of the local board of health for the purpose of filling in a small ravine adjoining a baseball park. Rubbish and ashes have been dumped at this site for the past two years. The dump extends parallel to Washington avenue for 150 to 200 feet and is some 20 feet deep. About 15 loads of ashes and rubbish are dumped at this site daily. As soon as the dump reaches the proper elevation it is covered with earth. It was cold and rainy on the day of the inspection but the odor of decomposing garbage could be detected at times when on the dump. The dump is located in a good residential section of the village. There are 4 or 5 houses within 200 feet of the dump, and about 12 within 400 feet of it.

At the time of the inspection the dump consisted of ashes, rubbish, papers, some garbage and other matter. It was learned that frequently people mixed garbage with the ashes. Article 43 of the Health Ordinances of the village of Ossining reads in part as follows: "No persons shall place together, mix, or have in the same receptacle, ashes and garbage. Violation of any of the provisions of this ordinance shall subject the offending person to a penalty of ten dollars." It is evident from the inspection that this ordinance is not being strictly enforced by the village authorities. The dump is located in such proximity to a residential section of the village that it is practically impossible to maintain the dump without creating conditions of nuisance, if garbage and tin cans containing vegetable and organic matter are allowed to be mixed with the ashes and rubbish and allowed to remain exposed on the dump. Unless garbage and all other matter containing organic or vegetable substances are excluded from the dump, the local board of health should require the discontinuance of the use of this dump between April 1 and

November 1, and only approve of a site well removed from a residential section so that no conditions of nuisance may be created.

A new contract for the removal of ashes, household refuse, and garbage in the village of Ossining was let to Mr. Isaac Kamm for a period of five years beginning November 21, 1920. According to the specifications of the contract, the village will provide a dumping ground for the disposal of all ashes and household refuse collected under the contract, and the contractor will provide and maintain a dumping ground outside of the village limits for the disposal of all garbage.

In view of the above facts the following conclusions may be drawn:

1. That the refuse dump concerning which complaint was made to this Department is located in a residential section of the village of Ossining in close proximity to a number of houses.
2. That the dumping of garbage and other odoriferous matter with the ashes causes objectionable conditions.
3. That no conditions of nuisance existed at the time of the inspection owing undoubtedly to the cold rainy weather, but during the summer under certain atmospheric conditions a nuisance might be created.

I therefore recommend:

1. That the local board of health require that the dump, in view of its location, be maintained in a condition free from objection at all times.
2. That the village authorities strictly enforce article 43 of the Health Ordinances, which requires that no person shall place together, mix, or have in the same receptacle, ashes and garbage.
3. That if it is found to be impossible to maintain a complete separation of ashes and garbage, the local board of health require the discontinuance of the use of the dump at Washington and South Highland avenues between April 1 and November 1, and a site be chosen well removed from a residential section so that no conditions of nuisance may be created.

I further recommend that copies of this report be sent to the local board of health, to the sanitary supervisor of the district, and to the complainants.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *December* 1, 1920

In accordance with the above recommendations, copies of the report were sent on December 1, 1920, to the sanitary supervisor, to the village president, the local board of health of Ossining and to the complainants.

PELHAM (Knickerbocker Ice Company)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an inspection of the plant of the Knickerbocker Ice Company, Inc., of Pelham, N. Y., made upon complaint to this Department that the manufactured ice contained considerable dirt and other foreign material. The inspection was made by Mr. N. H. Baier, sanitary inspector in this Department, on August 13, 1920, accompanied by Dr. E. S. Newell, health officer of Pelham, and Mr. Richard Handibode, chief engineer of the Pelham ice plant. A number of persons who were users of the ice were also interviewed.

The Pelham plant of the Knickerbocker Ice Company, Inc., is located in the western part of the village of Pelham, near the New York, New Haven and Hartford railroad and the city line of Mount Vernon. The main office of the company is at 1480 Broadway, New York city.

The manufacture of ice was begun in 1918, and is carried on from April to December of each year. There are 28 men employed in three shifts. The water supply of the plant is derived from two sources — for condensing purposes, which requires about 50,000 gallons daily, the water is obtained from a well near the plant; the water for the making of the ice, which requires

40,000 gallons daily, is obtained from the New York Inter-Urban Water Company. The daily output is 135 tons of ice, sold in Pelham, New Rochelle, and Mount Vernon, either directly or through independent dealers. Practically no ice is stored, the ice being sold as soon as it is manufactured.

A brief description of the machinery used will be given and the method of manufacturing of the ice outlined. On the main floor are the Frick Compound ice machines, which include a steam engine and compressor, and also a steam condenser, skimmer, and reboiler. On the second floor are a small freezing tank and ice storage room. On the third floor are the larger freezing tank, ammonia condenser, and charcoal filters. The process employed is the can system, using the ammonia compression system for freezing.

The ammonia compression process is essentially as follows: · The compressed ammonia gas first passes to an oil cooler, the oil being retained in the oil separator, and the gas, after being liquefied in the ammonia condenser, passes into the separating tank. From this tank the liquid is fed as required into the coils of the freezing tank, where expansion takes place, thence passing again in the form of gas to the compressor.

Well water is used to cool the ammonia condenser. This water is pumped from a well near the plant to a water storage tank. From this tank the water flows by gravity through a network of pipes over the ammonia condensers and discharges onto the concrete floor under the condensers. From the concrete floor the condenser water which has been heated in passing over the condensers flows to pipes leading to an 8-inch steel pipe which discharges into the Hutchinson river.

The water of the village water supply is used in the boiler to generate steam for driving the steam engine. The exhaust steam from the engine then passes to the steam condenser where condensation takes place, thence to the skimmer, where any oil that may have passed through with the steam is removed. The water resulting from the condensed steam passes to the reboiler where distillation takes place. It then passes through the cooling coil, thence to the charcoal filters, of which there are 8, each being 4 feet in diameter and 7 feet deep. From these filters the water passes to the cold water storage tank which feeds the cans in the freezing tank.

There are two freezing tanks, one of 900, the other of 700 can capacity. They are made of galvanized iron and contain the direct expansion freezing coils equally distributed throughout the tank. These coils are submerged in brine, consisting of a solution of common salt maintained at a temperature of 14° F. The tanks are provided with 4 agitators, to keep the brine in motion. The capacity of each can in 300 pounds, approximately 42 hours being necessary for freezing. Each can is covered with a wooden board 2¼ feet by 1½ feet by 2 inches thick.

In filling the ice cans a so-called float filler is used. This filler is carried by an employee to the can to be filled, the tube placed into the can, and then a valve lifted which automatically fills the can to the desired depth.

The ice is harvested from the tanks by means of a one-ton electric hoist on a traveling crane. The hoist removes 3 cans at a time, delivers them to the thawing tank which is of galvanized iron, which contains well water heated by steam, and is just large enough to hold the 3 cans. The cans are immersed in the tank for 5 minutes, the ice then removed, placed on dumping boards, slid to an elevator operated by a compressed air piston lift, and carried to the ice storage room.

At the time of inspection there was considerable ice in the storage room. An examination of these blocks failed to disclose any appreciable amount of foreign matter in the ice. There were a few blocks, however, which contained brown or black spots near the edges of the blocks. Each cake had a white core, due presumably to the entrained air in filling the cans from the top, the air being concentrated at the center of the block as the water freezes inward.

From the investigation made, there appeared a number of places which would permit the entrance of dirt or other foreign material. The first is from the individual wooden covers over the ice cans. These covers, as placed together, leave small openings through which dirt from workmen's boots may be easily washed and carried into the cans. A number of the covers were lifted and the cans as well as the half-frozen water examined. The inside of a few of the cans were dirty and rusty, while the water which was not as yet frozen contained small red particles, evidently iron rust.

The thawing tank as well as the water in it was very dirty. The galvanized iron was coated with a thick, slimy, red rust. In placing the cans into the tank for thawing, the water might easily overflow the can under the present arrangement. In this way not only the ice but the can itself would become dirty. Mr. Handibode stated that when this happens the can is washed before it is again used. The cans are ordinarily washed only once a year.

In view of the above facts the following conclusions may be drawn:

1. That dirt from workmen's boots can easily gain access to the water in the ice cans in the freezing tank through the openings between the boards covering the cans.
2. That the water in the thawing tank contains considerable dirt and iron and that these impurities may be transferred to the ice.
3. That the cans in which the ice is frozen may become coated with rust and dirt from the water in the thawing tank.

I therefore recommend:

1. That there be a small anteroom near the freezing rooms, where the workmen should be required to clean their boots thoroughly before entering, and that the floor of this room be concreted and properly drained.
2. That the water in the thawing tank be refilled with clean water at least once a day.
3. That the thawing tank be thoroughly cleaned at least once a day.
4. That the ice cans be cleaned after each freezing.
5. That the charcoal filters be washed out regularly.

I further recommend that copies of this report be sent to the local board of health, to the sanitary supervisor, to the Knickerbocker Ice Company, Inc., and to Dr. LeRoy E. Hubbard.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *August* 20, 1920

Copies of this report were sent on August 25, 1920, to the Knickerbocker Ice Company, Inc., to the sanitary supervisor, and to the local board of health. On September 1, 1920, a communication was received from Knickerbocker Ice Company, Inc., stating that the recommendations would be carried out so far as practicable so to do.

PELHAM (Westchester Chemical Company)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report upon an investigation of an alleged nuisance caused by the operation of the chemical works of the Westchester Chemical Company at Pelham, Westchester county, N. Y., which was made the subject of a complaint to this Department. Briefly stated the substance of the complaint is that the odor coming from the direction of the works is so disagreeable that it makes children sick and causes them to vomit.

The chemical works, its surroundings, and the methods of operation were carfully inspected; and the superintendent of the plant, the local health officer, and people living in the vicinity were interviewed. The investigation was made on June 15, 1920, by Mr. A. I. Howd, assistant engineer in this Department, accompanied by Mr. C. F. Hobson, superintendent of the works of the Westchester Chemical Company.

The works of the Westchester Chemical Company, of which Mr. Theodore Haebler is president, are located in the western part of the village of Pelham, near the New York, New Haven and Hartford Railroad and the city line of Mount Vernon. A number of fine residences are located within several hundred feet of the plant. The works have been in operation at the present location since June 15, 1918, employing about 11 men.

The Westchester Chemical Company is engaged in the manufacture of lactic acid from sugar by the fermentation process. The process of manufacture is briefly as follows: A sugar solution is formed by blowing steam into a mixture of starch, sulphuric acid, and water, and stirring for 2 hours. The solution is then pumped into wooden ferment tanks, lime added, and the mixture allowed to remain in the tanks for 7 days. Butyric acid is formed at this point of the process, but at the time of the inspection practically no trace of the odor could be detected in the room in which the tanks were located. After fermentation the turbid liquid resulting is passed through a closed filter to clarify it. From the filter the liquid flows into a tank from which it is pumped to two decomposing tanks where sulphuric acid is added to precipitate the lime. Here it is stirred for about 15 minutes while the sulphuric acid is being added, and then allowed to stand for about 12 hours for the calcium sulphate to settle out. The liquid at this point usually contains less than 9 per cent of lactic acid. After this settlement the liquid is conducted to a vacuum pan where it is heated and then discharged into a tank for the further settlement of the calcium sulphate. It is then sucked back into the vacuum pan and evaporated to the desired concentration. The acid after this concentration is run into barreling tanks and barreled.

Two points were observed in the process of manufacture where odors might be given off. The first point is the two decomposing tanks where odors might escape when the liquid is being stirred while adding the sulphuric acid, and while it is allowed to stand uncovered for 12 hours while the calcium sulphate is settling out. Secondly, odors and vapors are given off when the acid is being heated and evaporated to the proper concentration in the vacuum pan.

The decomposing tanks are cylindrical in shape, constructed of wood, and are not provided with covers. The tops of the tanks are at an elevation of a few feet below the concrete roof of the building. In the room there is but one small window, which at the time of the inspection was open. There are two distinct odors apparently arising from the tanks, one a sharp acetic acid odor and the other a nauseating butyric acid odor. These odors could not be definitely detected in the adjoining room of the building. If tight covers were provided for these tanks, the volume of the odors that escape from these sources might be considerably reduced.

The odors and vapors given off from the vacuum pan escape through an 18-inch outlet pipe. A 3-inch pipe filled with numerous small holes is located in the center of this outlet, and water is sprayed continuously from this pipe when the vacuum pan is being operated, to condense the vapors in the 18-inch outlet pipe thus reducing the possibility of the escape of odors. At the time of the inspection the waste water was being discharged into the public sewer system. It was estimated that about 100,000 to 150,000 gallons of water per day are used in this scrubber. The water is obtained from driven wells.

Ordinarily the waste water is not discharged into the sewer system, but pumped to spray nozzles on the roof of a portion of the building, a waterproof brick wall preventing it from flowing off the roof. The water is kept alkaline by adding lime to it, which should in a large measure prevent the emanation of objectionable odors. The water after aeration is again used in the scrubber. Since the spray nozzles on the roof were not in operation at the time of the inspection no definite statement can be made regarding the emanation of odors from this point. About the 10th of May of this year the wall on the roof gave way allowing the water to run off onto ground. It was stated that at that time the water may have evaporated and given off offensive odors. The new wall had just been completed at the time of the inspection and was to be put in use the following day.

At the time of the inspection no offensive or objectionable odors could be detected outside the chemical works. During the past year the local board of health of the village of Pelham has received but 3 complaints in regard to odors from the Westchester Chemical Company, all of which were made about the time and shortly after the roof wall gave way which held back the water from the scrubber. The local board of health of the City of Mount Vernon reports numerous complaints with reference to odors from the chemical works.

The superintendent of the works, Mr. Hobson, stated that the company was willing to do anything possible to prevent the escape of offensive and objectionable odors from the plant. The men working at the plant have become practically immune to the odors and it is difficult for them to detect them. Mr. Hobson further stated that he desired to have people living in the vicinity inform him of the nature of the odors and the time when they detect them escaping so that he may know at just what points of the process the escape of odors is noticed. Effective action might then be taken to prevent a re-occurrence of their escape.

In view of the above facts the following conclusions may be drawn:

1. That objectionable odors may escape from the decomposing tank when the liquid is being stirred while adding sulphuric acid, and when the liquid is in a quiescent state allowing the sulphate of lime to settle out.
2. That objectionable odors and vapors might escape from vacuum pan if scrubber is not operated continuously.
3. That the plant of the Westchester Chemical Company is located in a fine residential section, and unless the plant is carefully operated, conditions of nuisance may be created.

I therefore recommend:

1. That the Westchester Chemical Company be advised to consider the matter of providing tight covers for the decomposing tank to prevent the escape of odors from these tanks.
2. That the scrubber used in connection with the vacuum pan be operated without interruption at all times when vacuum pan is being used.
3. That the works of the Westchester Chemical Company be carefully operated at all times and that every precaution be taken by the authorities in charge of the plant to prevent the escape of odors and vapors in such a manner as to create a nuisance.
4. That the local boards of health of the village of Pelham and the city of Mount Vernon cooperate with the Westchester Chemical Company and immediately notify them of any escape of odors from the plant.

I further recommend that copies of this report be sent to local boards of health of the village of Pelham and City of Mount Vernon, to the sanitary supervisor of the district, and to the Westchester Chemical Company.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *July* 3, 1920

Copies of this report were sent on July 6, 1920, to the local board of health, to the sanitary supervisor, and to the Westchester Chemical Company.

POUGHKEEPSIE (Town) Knauss Brothers,

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report upon an investigation of alleged objectionable conditions caused by the operation of and disposal of wastes from the abattoir of Knauss Brothers, in the town of Poughkeepsie, Dutchess county, N. Y. The investigation was made on October 28, 1920, by Mr. A. I. Howd, assistant engineer in this department, accompanied by the health officer of the town of Poughkeepsie, as a result of the complaint of objectionable odors and offensive conditions created by the operation of this plant, and at the request of the local board of health of the town of Poughkeepsie.

The abattoir or slaughter house of Knauss Brothers is located in the town of Poughkeepsie about one and one-half miles north of the city of Poughkeepsie. The abattoir was constructed during 1919 and 1920, and was put in operation in April, 1920. The plant is engaged in the slaughtering of pigs and beef and the rendering of the entrails and waste products of the animals. At the time of the inspection a maximum of 150 pigs and 25 beefs were slaughtered weekly. The plant has a capacity of about double this amount. The slaughtering is done about once or twice a week and the wastes are rendered once or twick a week.

The method of rendering the wastes is briefly as follows: The waste products from the slaughtering of the animals are put into a digester of the Wannenwetsch type and cooked for 4 or 5 hours by live steam at 40 pounds pressure. The grease is then drawn off into a closed storage tank and the water is discharged into a cesspool. The tankage is agitated and dried simultaneously with steam which is applied to the steam jacket surrounding the bottom of the digester. The vapors and gases generated during the processes of rendering are conveyed through a pipe to a vacuum pump and jet condenser and discharged into the cesspool referred to above. No estimate could be obtained as to the amount of water used in the condenser.

The waste water and condensing water resulting from the rendering process are discharged through a 6-inch pipe to the cesspool located a short distance north of the plant. The cesspool which is 10 feet in diameter and 10 feet deep is loosely stoned up and is provided with a concrete cover. When first put into use the cesspool operated satisfactorily for a short time. The cesspool then filled up and an overflow pipe line was run to a pond or swamp about 150 feet north of the cesspool. When complaint was made concerning the objectionable conditions created by overflow of the cesspool, two large trenches were constructed, filled with rocks and then covered with earth. The overflow from the cesspool was then diverted into these trenches. At the time of the inspection the wastes were flowing out into the swamp from the end of the trenches.

The pond or swamp receiving the overflow from the trenches is roughly some 150 feet in diameter, and was formed by the construction of a railroad embankment across a low depression which was the natural course of drainage for a relatively small area in the vicinity of the abattoir. The construction of the railroad embankment some years ago caused the runoff from this area to back up and form a marsh which contains water most of the year. This condition has become more aggravated during the past six months by the discharge of wastes from the abattoir. At the time of the inspection a light scum was noticeable on portions of the swamp and an objectionable odor could be detected in the immediate vicinity. No odor could be detected a few hundred feet from the swamp but the conditions were unsightly. It seems, therefore, that while objectionable conditions were created, at the time of the inspection no conditions of public nuisance existed. It should be remembered that it was cool on the day of the inspection and there was practically no wind. During warm weather under certain atmospheric conditions it seems that conditions of nuisance would probably be created. The discharge of wastes from the abattoir also without a permit from this Department is a direct violation of Article V of the Public Health Law.

Pilgrim Hall, a reception building of the Hudson River State Hospital, is situated about three-forths of a mile north of the abattoir and the swamp. It was stated by hospital authorities that the odor emanaging from the abattoir and swamp is very objectionable to the patients at the hospital. Complaint was also made concerning the extraordinary prevalence of mosquitoes and flies at the hospital. There are also several residence located within a half mile east and south of the plant which might be affected by any nuisance resulting from the operation of the abattoir.

There are evidently three classes of wastes to be disposed of from the abattoir. The first class consists of the condensing water which includes the condensed vapors and gases generated in the processes of rendering. The water generally is practically free from any solid or suspended matter but may give off a slight odor. This class of wastes might be discharged into a stream or watercourse without creating objectionable conditions. Although no figures could be obtained as to the amount of the wastes, they are known to be relatively large. The second class of wastes consists of the water which is drawn off from the digester after the process of rendering. This water may contain particles of grease, tankage, and other solid and suspended matter, and should therefore be passed through a settling tank having a capacity sufficient to provide a detention of the wastes of 8 or 10 hours, and the effluent treated by some method of filtration. The effluent from the filter beds might be discharged into a stream or watercourse together with the condensing water. This class of wastes is relatively small. The third class of wastes consists of washings from floors and apparatus and may contain small amounts of blood, scraps, dirt, and other solid matter which might find its way to the floors of the plant. In view of the nature of this class of wastes they should be discharged, together with the water from the digester, into a settling tank.

In view of the many features involved in the proper disposal of the wastes, a competent engineer should be employed by the owners of the abattoir to prepare plans for the treatment and disposal of wastes from their plant in the town of Poughkeepsie. These plans when prepared should be submitted to and receive the approval of this Department, in accordance with the provisions of the Public Health Law.

In view of the above facts the following conclusions may be drawn:

1. That the construction of a railroad embankment without a culvert across a natural drainage course a short distance north of the abattoir of Knauss Brothers, in the town of Poughkeepsie, causes surface and ground water to accumulate and create marshy and objectionable conditions.
2. That the above conditions become more aggravated by the discharge of wastes from Knauss Brothers' abattoir into the marshy area.
3. That objectionable conditions were created at the time of the inspection, and conditions of nuisance would probably exist during warm weather under certain atmospheric conditions.
4. That the discharge of wastes from this abattoir without a permit is a direct violation of Article V of the Public Health Law.
5. That the abattoir was maintained in a fairly cleanly condition at the time of the inspection.

I therefore recommend:

1. That the local board of health of the town of Poughkeepsie require the proper authorities to take action to relieve the swampy and objectionable conditions created by the construction of a railroad embankment across a natural drainage course in the town of Poughkeepsie near the abattoir of Knauss Brothers, either by the construction of a culvert under the railroad at the proper point or by some other satisfactory method.
2. That Knauss Brothers take immediate steps to discontinue the discharge of untreated wastes from their plant, and employ a competent engineer to prepare plans for the treatment and disposal of wastes from their abattoir in the town of Poughkeepsie, and that the plans when completed be submitted to this Department for approval, together with an application for a permit, in accordance with the provisions of Article V of the Public Health Law.

I further recommend that copies of this report be sent to the local board of health of the town of Poughkeepsie, to the sanitary supervisor of the district, to Knauss Brothers, and to the Superintendent of the Hudson River State Hospital.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *November* 12, 1920

Copies of this report were sent on November 15, 1920, to the local board of health, to the sanitary supervisor, to the complainant, and to Knauss Brothers. On November 30, 1920, a communication was received from Knauss Brothers, in which it was stated that an engineer had been employed to prepare plans for the treatment and disposal of wastes from the abattoir and that steps had been taken to drain the swamp.

ROME (Rome Gas, Electric Light and Power Company)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report upon an investigation of alleged objectionable conditions arising from the use of the gas of the Rome Gas, Electric Light and Power Company, of Rome, N. Y., which inspection was made at the request of Dr. C. R. Mahady, health officer of the City of Rome, who had received numerous complaints from the users of the gas that disagreeable and at times unendurable odors of sulphur and its compounds were given off in the use of this gas for either heating or illuminating purposes.

The inspection of the gas plant was made by Mr. N. H. Baier, sanitary inspector in this Department, on September 2, 1920, accompanied by Mr. A. B. Morton, manager of the company. Dr. C. R. Mahady, health officer, and Dr. H. B. White, member of the local board of health, and Mr. G. A. Mickle, Mayor of the city of Rome, were interviewed.

The Rome Gas, Electric Light and Power company is engaged in the manufacture of coal gas and water gas. In the manufacture of coal gas the byproducts are coke, tar, and ammonia. The process of manufacture is briefly as follows: Bituminous coal is subjected to destructive distillation in inclined retorts, arranged in 6 benches, with 5 retorts to a bench. The coal is heated for 6 hours, at the end of which time the coke is discharged by gravity to bins and quenched, put on cars which carry the coke to an elevator, and conveyed to the coke shed. The gases given off in the combustion or distillation of the coal pass through an opening at the lower end of the retort to a vetical castiron pipe or standpipe leading to a rectangular box or water seal, which serves one bench. In the water seal, the greater part of the tar and oily products condense and collect under the water. The gases then pass to the primary condenser, which consists of a system of tubes surrounded by flowing water, where the temperature of the gas is reduced in passing through the tubes from 150°F. to 105°F. A so-called exhauster draws the gas from the retort through the water seal and primary condenser, and pumps it through the remaining parts of the plant. The tar extractor further purifies the gas. It then passes through the scrubber and washer to remove the ammonia and part of the carbon dioxide and hydrogen sulphide. The gas then passes through a secondary condenser and rotary scrubber, thence to the purifier, composed of layers of hydrated ferric oxide, to remove the sulphur compounds. The gas is in contact with this purifying material for from 4 to 6 minutes. The purified gas then passes through a station meter, and finally to a holder.

The manufacture of water gas is briefly as follows: Coke is placed in a generator, which consists of a steel cylindrical shell 6 feet 6 inches in diameter and 9 feet high, lined with firebrick. The coke in the generator is intermittently brought to incandescence by a blast of air. Each charge of coke is fired 5 times, with 5 minutes to a blast. The gases from the generator enter at the top of the carburetter, a second steel cylindrical shell lined with firebrick and containing a firebrick checkerwork. In passing down through the carburetter the producer gas from the generator is partly burned by an air blast which enters the apparatus near the top, heating the checkerwork white hot. The gases then pass to the superheater, a taller chamber, similarly filled with checkerwork. When both the carburetter and the superheater have reached the desired temperature, the air blasts are cut off and steam is introduced into the generator. The water gas thus formed passes to the carburetter while a small stream of oil is being introduced through a pipe at the top. The oil, called "gas oil," which is a third distillation of crude oil, is applied for about 5 minutes. The lower end of the pipe leading from the superheater is closed by a round wash water seal to prevent the return of the gas to the apparatus. From the water seal the gas passes to the scrubber, where the first operation of cleansing and purification takes place. The exhauster then draws the gas through the condenser to condense the gas properly, through the wash box, and thence to the purifiers, which contain layers of iron oxide, similar to those for the purification of the coal gas. The gas from the water gas meter and the gas from the coal gas meter then enter the holder, where the two gases combine before being delivered to the street mains.

The capacity of the plant is 500,000 cubic feet of coal gas and 350,000 cubic feet of water gas per day. The average amount of gas supplied per day is from 450,000 to 500,000 cubic feet. As delivered to the consumer, the gas contains about 70 per cent coal gas and 30 per cent water gas.

The only test that is performed at the plant to ascertain the presence of impurities is that for hydrogen sulphide, this test being made at the station meter. The gas is impinged through a pet-cock on a strip of white paper which is moistened with a solution of acetate of lead. The presence of the sulphide is indicated by the discoloration of the paper. The amount of the discoloration depends on the quantity of the sulpherated hydrogen contained in the gas, and the length of time given to the exposure. At the time of inspection the test of the coal gas gave a decided dark brown discoloration almost instantaneously. Although there was considerable variation in this discoloration from one test to another, made but a minute or two apart, each of the tests that were made indicated a high percentage of hydrogen sulphide. The test on the water gas gave but a slight discoloration, showing that it contained only a small amount of the hydrogen sulphide. A good gas coal should preferably have less than 0.7 per cent of sulphur. The gas as delivered to the consumer should have not more than 20 grains of sulphur per 100 cubic feet of gas.

In interviewing the manager of the gas company it was learned that the company had, up to December, 1919, been receiving two grades of good bituminous coal, the West Moreland coal and the Yahegany coal. Since last December, however, the company has been unable to get their usual supply from these sources, and it has been necessary to use whatever coal they could purchase, regardless of the quality of the coal as to its sulphur contents. Under these circumstances the coal that has been purchased contained at times such large amounts of sulphur that the scrubbers and ferric oride purifiers could not remove it.

Beginning with August 27, 1920, when the first complaint about the gas was made to Dr. Mahady, the sulphur in the gas was detected at different times and at different localities. According to the persons interviewed, the amount of sulphur in the gas appeared to have reached a maximun on Sunday, August 29, 1920. It was claimed that the sulphur fumes on this day were so intense that the use of the gas was at times almost an impossibility.

At the time of inspection the gas in a few houses was examined, both as an illuminant and as a fuel. No odor of sulphur was detected except at one moment, when a very marked odor was noted, but this odor lasted only for an instant.

According to a telegram received September 1, 1920, by the Rome Gas, Electric Light and Power Company from the coal company which furnishes the coal, 2 cars of West Moreland coal left the mine on August 31, 1920, and 2 cars will be shipped to Rome daily thereafter. It would seem that the use of this coal for the manufacture of gas should remedy the present unsatisfactory conditions arising from the use of a poor grade of coal.

In view of the above facts the following conclusions may be drawn:

1. That the coal that is at present being used by the Rome Gas, Electric Light and Power Company is unsuitable for the manufacture of coal gas, due to its large sulphur content.

2. That the use of this gas as now manufactured by the Rome Gas, Electric Light and Power Company may at times prove deleterious to the health of the consumers.

3. That the Rome Gas, Electric Light and Power Company is at present attempting to obtain a satisfactory gas coal to remedy the present unsatisfactory conditions existing through the use of a poor grade of coal in the manufacture of gas.

As a result of the inspection and in view of the foregoing I would recommend:

1. That the Rome Gas, Electric Light and Power Company abandon the use of the poor grade of coal as soon as the West Moreland coal or some other satisfactory coal can be obtained.

2. That the Rome Gas, Electric Light and Power Company take the necessary steps to obtain an adequate supply of good gas coal so that congested freight conditions, expiration of present contracts, or similar conditions that would delay or hinder the receipt of the usual supply of good gas coal will not interfere with the production of a gas of satisfactory nature.

3. That the Rome Gas, Electric Light and Power Company have frequent tests made at regular intervals, by an expert industrial chemist, of the coal that is to be used for the manufacture of gas, of the resulting coal gas and water gas, and also tests of the gas as finally delivered to the consumer, to ascertain the percentage of impurities contained therein, with particular reference to the amount of sulphur and its compounds, so that the quality of the gas delivered to the consumer may be more definitely determined.

I would further recommend that copies of this report be sent to the local board of health, to the sanitary supervisor of the district, and to Mr. A. B. Morton, Manager of the Rome Gas, Electric Light and Power Company.

Respectfully submitted
THEODORE HORTON
ALBANY, N. Y., *September* 10, 1920 *Chief Engineer*

Copies of this report were sent on September 20, 1920, to the local board of health, to the sanitary supervisor, and to the Rome Gas, Electric Light and Power Company. On September 25 a communication was received from the company, in which it was stated that the recommendations of the report would be carried out.

SAVANNAH (Shefford Cheese Company, Inc.)

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report upon an investigation of an alleged nuisance caused by the discharge of wastes from the factory of the Shefford Cheese Company, Inc., at Savannah, Wayne county, N. Y., into a small stream, which was made the subject of a complaint to this Department. The inspection was made on June 3, 1920, by Mr. A. I. Howd, assistant engineer in this Department, accompanied by Dr. W. H. Sweeting, health officer of the town and village of Savannah; Dr. D. W. Pierce; Mr. V. D. Tallman, president of the village; Mr. T. C. Wethey, village trustee; and Mr. S. E. Wood, town supervisor.

Savannah is an incorporated village having a population of 531 according to the census of 1915, located in the southeastern part of Wayne county. It is on the New York Central railroad, the West Shore railroad, and the Rochester and Syracuse Electric railroad, about 34 miles west of Syracuse. A small stream rises about one mile south of the village, flows through the village, and discharges into Crusoe creek, about two miles distant. The village has no public water supply and no sewerage system.

The cheese factory is located in the northern part of the village near the small stream mentioned above. The factory is owned and operated by the Shefford Cheese Company, Inc., of 419 Fulton street, Syracuse, N. Y., of which Mr. F. W. Chesire is president. Mr. Leon Calandrin is superintendent of the plant at Savannah. The plant was put in operation about 1905, but has been operated by the present firm only for the past four years. The factory is engaged in the manufacture of soft cream cheese, employing from 4 to 6 men. The amount of milk received at the factory varies from 1,500 to 5,000 pounds daily, depending on the season, the maximum amount being received at the time of the inspection. About 1,000 pounds of cheese was being manufactured daily.

The process of manufacture is briefly as follows: The milk is received, weighed, and run into a batch pasteurizer, where it is pasteurized and cooled. "Commercial starter" is added for ripening the milk, which drawn off into 18-quart cans, carried into the "setting room," and allowed to stand for 18 to 24 hours. The contents of the cans run into cheese cloths in the "draining room," the whey running through the cloths on to the floor. The cheese is iced, salted, packed in butter tubs, and shipped.

The water supply of the factory is obtained from a dug well 18 inches in diameter and 25 feet deep, located several feet west of the factory. The water is pumped from the well directly into the mains. A new driven well 6 inches in diameter and 50 feet deep had been constructed near the plant but had not been put into use at the time of the inspection.

In general, there are two classes of wastes to be disposed of from the factory. The first is whey, which amounts to about 3,000 pounds daily. The whey is collected on the floor of the draining room from which it is pumped by an ejector with a 1½-inch suction and 1½-inch discharge into a vat outside the building. The superintendent of the plant stated that all of the whey is taken away by the farmers. The ejector was installed about two weeks previous to the time of the inspection. Prior to the installation of the ejector the whey was discharged through a 6-inch pipe into a cesspool having an overflow into a small stream.

The second class of wastes consists principally of the wash water from floors, cans, and apparatus, and contains slight quantities of milk, whey, curd, and other matter. About 2,000 to 3,000 gallons of water are used daily for washing purposes. The waste water and washings are discharged through a 6-inch floor drain into a concrete cesspool about 8 feet in diameter and 3½ feet deep, constructed in the fall of 1919. The effluent from the cesspool is carried through a 6-inch pipe for about 125 feet to the small stream running in a northerly direction from the village. In the vicinity of the plant the top soil for a depth of about 1 foot is a gravelly loam, which is underlain by about 2 to 3 feet of clay. The ground water elevation is about 4 feet below the surface of the ground.

The discharge of wastes from this factory into the stream is a violation of section 78 and 79 of the Public Health Law, since no permission has been granted and no plans submitted for the treatment and discharge of wastes into the stream. It would seem desirable that they be advised to submit plans to this Department showing the method of disposal of their wastes, and to make application to this Department for permission to discharge their wastes into the stream.

The ditch or stream into which the wastes are discharged has a drainage area of about 0.25 square mile above the point of discharge of the wastes. The volume of flow in the stream at the time of inspection was very small. The stream contained quantities of scum and settled decomposing organic matter. The characteristic odor emanating from this type of matter could be detected a short distance from the stream when in the direct path of the wind. The odor could be detected when near the stream for a distance of probably a half mile below the plant. A mile below the plant there was practically no visible pollution of the stream.

The present objectionable conditions along the stream are probably due largely to the whey which was formerly discharged into the stream. Whey contains such large quantities of decomposable organic matter that it is practically impossible satisfactorily to dispose of it by discharging it into relatively small streams without creating a nuisance. The practice of having the whey taken away by farmers is an economical and generally satisfactory method of disposal. Care should be taken that all of the whey is taken away daily and none allowed to be discharged into the cesspool or the stream.

The objectionable conditions along the stream may also be due partly to the waste water and washings which are being discharged into it after treatment in the cesspool. In cases where the volume of stream flow is large enough to provide ample dilution, treatment of the waste water and washings in a settling tank or tight cesspool may be sufficient. When the volume of flow in the stream is not sufficient properly to dilute the effluent from the settling tank or cesspool treating the waste water and washings, it is necessary that supplementary works for more complete treatment of these wastes be provided, such as some form of filter, or where soil conditions are favorable, the construction of leaching cesspools to receive and dispose of the effluent from the tanks, or tight cesspools.

The stream should be cleaned of all putrefying organic wastes that have been discharged into it from the point of discharge of the wastes as far as objectionable conditions are created. The owners of the factory should then be given an opportunity to operate the cesspool properly, excluding all whey and other refuse containing considerable amounts of organic matter. If it be found after a reasonable time that the volume of flow in the stream is not sufficient properly to dilute the effluent from the cesspool, it will be necessary to provide supplementary works for more complet treatment of the wastes, plans for which should be submitted to this Department for approval.

It was alleged at the time of the inspection that sewage from residences in the village is discharged into the stream above the factory. Since the stream was covered for some distance through the village it could not be definitely determined at the time whether or not there were any house connections to the stream. The local board of health of the village should make a careful survey of the parts of the village involved with a view of improving the sanitary condition of the stream in the village.

As a result of this inspection, I conclude that the objectionable conditions complained of are caused by the conditions mentioned above, and I therefore recommend:

1. That the owners of the factory continue to have all the whey taken away by farmers, and allow none to enter the cesspool or the small stream west of the factory.
2. That the cesspool be used to treat the wash water only, and that the matter of additional treatment be held in abeyance until it is determined whether or not conditions of nuisance are caused when the cesspool is operated properly.
3. That the stream be cleaned of all putrefying organic wastes that have been discharged into it from the point of discharge of the wastes as far as objectionable conditions are created.
4. That the owners of the factory submit to this Department for approval plans showing the present works for the treatment and disposal of the wastes, and that they make application to this Department for permission to discharge the waste water and washings from the factory into the stream.

I further recommend that copies of this report be sent to the local boards of health of the village and town of Savannah, to the sanitary supervisor of the district, to the complainant, and to the Shefford Cheese Company, Inc., at Syracuse, N. Y.

Respectfully submitted

THEODORE HORTON

Chief Engineer

ALBANY, N. Y., *June* 30, 1920

Copies of this report were sent on July 1, 1920, to the Shefford Cheese Company, Inc., to the local boards of health of the Town and Village of Savannah, to the sanitary supervisor, and to the complainant. On September 8, 1920, application was received for permission to discharge wastes from the factory. A permit was issued on September 17, 1920, for permission to discharge effluent from the settling tank to treat waste water and washings into a tributary of Crusoe creek.

In addition to the foregoing, inspections were made and reports transmitted to the local authorities or advice was given by correspondence in the matter of abatement of nuisances at the following places: Akron, Amsterdam, Chemung, Cornwall (town), Darien Center, Dundee, East Greenbush, East Moriches, Elmira, Geneseo (town), Harrison, Hempstead, Hudson, Kensico Manor, Kingston, Lancaster, Madrid Mannville (town of Colonie), Maplewood (town of Colonie), Marlborough (town), Mount Pleasant (town), Newark, Pittsford, Plattsburg, Port Chester, Purchase, Rotterdam (town), Schenectady, Skaneateles, Spring Lake (town of Conquest), Stephentown, Syracuse, and Van Hornesville.

SPECIAL INVESTIGATIONS

INVESTIGATION OF SANITARY CONDITION OF STATE INSTITUTIONS

Under the provisions of section 14 of the Public Health Law, the State Commissioner of Health is required to make from time to time, and at least once in each year, an examination and inspection of the sanitary conditions of all State institutions, and to transmit copies of his report and recommendations thereon to the president of the board of managers or trustees or other authority in charge of such institution, and to the Fiscal Supervisor of State Charities in case of institutions reporting to that official.

During 1920 the scope of investigation was confined to matters of water supply, milk supply, sewage and sewage disposal and refuse disposal. The sanitary conditions of some twenty-nine institutions were investigated during the year and reported upon, and as required by law the reports transmitted to the institution authorities.

Below will be found abstracts of the reports on the institutions investigated.

ALBION (Western House of Refuge for Women)

An investigation of the sanitary condition of the Western House of Refuge for Women at Albion, Orleans county, was made by Mr. C. A. Howland, assistant engineer in this Department, on January 14, 1920. Previous investigations of the institution were made by this Department in 1911 (see page 940 of the 32d Annual Report); in 1914 (see page 837, Vol. II, of the 36th Annual Report), and in 1917 (see page 631, Vol. II, of the 38th Annual Report). Special investigations of the sewage disposal plant of the institution were made in 1907 (see page 721, Vol. II, of the 28th Annual Report) and in 1908 (see page 199, Vol. II, of the 29th Annual Report). Plans for sewage disposal were approved by this Department on October 13, 1898, and on May 8, 1912.

Location: Village of Albion, Orleans county.

Site of institution: The institution is located near the western boundary of the village of Albion. The station of the New York Central railroad in the village is about one mile from the institution, and a station of the Buffalo, Lockport and Rochester Electric Railway is located practically at the gate of the institution. The Erie canal passes just to the north and the New York Central railroad just to the south. A small creek runs through the institution grounds. In the vicinity of the buildings the ground slopes are such that the drainage is good, but the engineer was informed that some portions of the farm lands are rather low and because of the improper arrangement of the drain tile are not well drained.

Area of grounds: 92.5 acres.

Number of occupied buildings: 13 (and one in course of construction).

Capacity: 215 women, 57 employees, total 272.

Present population: 174 women, 15 infants, 52 employees, total 241.

Class of inmates: The institution receives upon commitment females between the ages of 16 and 30 years, convicted by any court or magistrate of petit larceny, vagrancy, habitual drunkenness, of being a common prostitute, of frequenting disorderly houses or houses of prostitution, or of a misdemeanor, and who are not insane or mentally or physically incapable of substantially benefiting by the discipline of such institution.

Water supply: The principal water supply of the institution is obtained from the public water supply of the village of Albion. It is derived from an impounding reservoir on Otter creek, about two miles west of the village, and from wells located just outside of the village and north of the Erie Canal. The water is pumped, is filtered through gravity mechanical filters, and is treated with hypochlorite of lime. An auxiliary supply is obtained from a drilled well about 30 feet deep and extending into rock, which is located near the farmer's cottage. Water is drawn from it by means of a hand pump. At the time of the investigation it was found that a number of possible sources of contamination existed near the well, including a privy without vault, a cesspool, and an area of ground upon which sink drainage is discharged. A third grossly contaminated supply, which was obtained from a well near the power house, has been abandoned in accordance with the recommendations of this Department.

Milk supply: About 80 quarts of milk is obtained from the institution herd of 13 head, and 70 quarts by purchase from a milk dealer who obtains milk from local farmers. As no milk-house is provided near the barn, the milk from the institution herd is strained in the barn and taken directly to the industrial building, where it is again strained and delivered to the cottages where it is placed in refrigerators. It is used without pasteurization. Milk is purchased under a yearly contract which includes specifications as to butter fat and solid content of the milk and conditions under which the milk is to be produced, but none as to the grade of milk or pasteurization.

Sewerage and sewage disposal: The sanitary sewage of the institution is collected by a system of sewers and discharged through an 8-inch sewer into the sewerage system of the village of Albion. The sewage is therefore passed through the village sewage disposal plant consisting of a grit chamber, settling tanks, and contact beds before it is discharged into Sandy creek. The sewage from the flush closet and other plumbing fixtures, except the kitchen sink, at the farmer's cottage is discharged into a cesspool located in the garden about 60 feet north of the cottage. Sewage seeps out of the ground at the cesspool during the summer months, and it would therefore appear that the cesspool is no longer capable of satisfactorily disposing of the sewage from the farmer's cottage.

Refuse disposal: The garbage is stored in galvanized iron cans at each cottage. It is collected three times a week and taken to the piggery where it is fed to the institution herd of 24 swine. Combustible rubbish is burned in the kitchens of the several cottages, or is taken to the boiler house where it is burned. Noncombustible refuse is used for filling at a considerable distance from the buildings of the institution.

Recommendations

1. That in view of the potentially dangerous character of the water obtained from the well at the farmer's cottage, this well be abandoned.
2. That proper toilet facilities be provided at the barn, and that the privy near the barn be discontinued.
3. That the receptacle for the storage of the garbage at the piggery be provided with a cover and be kept covered.
4. That the construction of a properly designed and constructed system of sewage disposal for all of the sewage of the farmer's cottage be undertaken as soon as possible.
5. That arrangements be made by the institution authorities to use only pasteurized milk at the institution, either by pasteurizing all milk at the institution, or by pasteurizing the milk produced at the institution and purchasing only pasteurized milk; and that a properly designed and constructed milk-house be provided.

BATAVIA (State School for the Blind)

An investigation of the sanitary condition of the State School for the Blind at Batavia, Genesee county, was made by Mr. C. A. Howland, assistant engineer in this Department, on January 13, 1920. Previous investigations of the institution were made by this Department in 1911 (see page 948 of the 32d Annual Report); in 1914 (see page 476, Vol. II, of the 35th Annual Report) and in 1917 (see page 632, Vol. II, of the 38th Annual Report). A special investigation of the sewage disposal plant was made in 1907 (see page 726, Vol. II, of the 28th Annual Report).

Location: City of Batavia, Genesee county.

Site of institution: The institution is situated in the southern part of the city of Batavia, on property which is higher than the surrounding land.

Area of ground: 60.7 acres.

Number of occupied buildings: 11.

Capacity: 180 pupils consisting of 104 boys and 76 girls; 68 employees, total 248.

Present population: 86 boys, 63 girls, 68 employees, total 217.

Class of inmates: Blind persons between the ages of 5 and 21 years who are not incapacitated for useful instruction by mental, physical, or moral infirmity.

Water supply: The principal water supply for the school is obtained from the public water supply of the city of Batavia. This supply is derived from Tonawanda creek which is seriously contaminated. Before delivery to the city mains, however, the water is treated by coagulation, filtration through gravity mechanical filters, and chlorination with liquid chlorine. At the institution there are two systems of piping, one for drinking water and the other for general utility purposes. The latter, in addition to city water, at times receive rain water pumped from a cistern. Pumps have been installed to increase the pressure for fire purposes and to raise the service pressure in the mains when it becomes low. A small pump also raises water from the cistern to 2 or 3 tanks located in the attic of the main building. A float valve controls the entrance of water from the city water supply into the cistern from which the fire pump draws water. A second cistern supplies water to a hand pump located in a lavatory on the second floor of the main building. The utility supply is filtered at the main building and at the kindergarten. At the former a Continental-Jewell pressure mechanical filter is used, and at the latter a Paddock water filter unit.

Milk supply: The entire milk supply is purchased from the Fargo Dairy Company under verbal contract. Grade A pasteurized milk is used.

Sewerage and sewage disposal: A system of combined sewers ranging in size from 5 to 8 inches collects the sewage and as much of the storm water as is not used in the utility water supply. They are discharged into the city sewage disposal plant which consists of settling tanks, a dosing tank, and sprinkling filters. The cisterns of the institution overflow into the sanitary sewers, and the discharge of storm water in this manner into the sanitary sewerage system of Batavia may overload the city sewage disposal plant.

Refuse disposal: Garbage is stored in galvanized iron cans in the kitchens. It is collected daily by a farmer. Combustible rubbish is burned. Noncombustible rubbish is placed on a dump near a marshy area and at a considerable distance from the buildings.

Recommendations

1. That the pumping of storm water from the cisterns into the mains of the institution, and the use of this water for any purpose whereby it would be accessible to the persons at the institution for drinking purposes be discontinued.
2. That the filters at present used to filter the general utility supply at the institution be discontinued.

3. That all connections for the discharge of storm water or rain water into the sanitary sewers be disconnected, and such water be discharged into the storm sewers.

4. That only pasteurized milk be accepted and used at the institution.

BATH (State Soldiers' and Sailors' Home)

An investigation of the sanitary condition of the New York State Soldiers' and Sailors' Home at Bath, Steuben county, was made by Mr. W. C. Emigh, assistant engineer in this Department, on July 1 and 2, 1920. Previous investigations of the institution were made by this Department in 1911 (see page 957 of the 32d Annual Report), in 1914 (see page 476, Vol. II, of the 36th Annual Report), and in 1918 (see page 518, Vol. II, of the 39th Annual Report). A special investigation of the sewage disposal plant was made in 1907 (see page 728, Vol. I, of the 28th Annual Report). Plans for sewerage and sewage disposal were approved on August 27, 1909.

Location: Bath, Steuben county, N. Y.

Site of institution: The New York Soldiers' and Sailors' Home is situated on the south bank of the Cohocton river, about 2 miles northwest of the village of Bath. The grounds of the institution rise from an elevation of about 1,225 feet above mean sea level at the river to an elevation of 1,500 feet about three-quarters of a mile south of the river. The main buildings are located on a strip of low level land about one-quarter of a mile wide immediately adjacent to the river.

Area of grounds: 375.5 acres.

Number of occupied buildings: About 40.

Capacity: 1,600 men, 179 employees, total 1,779.

Present population: 600 men, 174 employees, total 774.

Class of inmates: Honorably discharged soldiers and sailors who served in the army or navy of the United States during the late rebellion, who enlisted from the State of New York, or who shall have been residents of the State for one year preceding their application for admission.

Water supply: The institution water supply is derived from two separate sources: A battery of three wells located under the power house, and three springs on the institution farm. Water is pumped from the wells directly into the distribution mains by pumps located in the basement of the power house. The surplus water from the mains flows into a reservoir located on a hill in the rear of the institution buildings. The springs are all located within a short distance of the institution farm house. The area above the springs is unpopulated and no permanent sources of pollution were found thereon. Water collected from the three springs is piped to the reservoir previously mentioned. The water mains in the institution are cross-connected to the municipal water supply of the village of Bath.

Milk supply: The milk supply of the institution is obtained from the institution herd and from a local dairy. The former furnishes about 400 quarts daily, and the latter about 100 quarts. Subsequent to the inspection of 1918, the cow barn and stable have been rebuilt. The milk house is a separate building but in convenient proximity to the stable. Neither the milk produced at the institution nor that purchased from the local dairy is pasteurized.

Sewerage and sewage disposal: The sanitary sewage and storm water of the institution are collected in separate system of sewers. The sanitary sewers lead to a disposal plant which consists of two primary settling tanks and two secondary settling tanks. The filter plant was designed and constructed to be operated as a chemical precipitation tank. The quantity of chemicals used has been decreased from year to year until at the present time only a negligible quantity is used, and the plant is operated as a plain sedimentation tank. The effluent of the plant is discharged into the Cohocton river. Sewage from the superintendent's residence, the farm house, and the cottages south of the main gate is disposed of by three separate tanks or cesspools.

Refuse disposal: A garbage house is provided near each of the two main kitchens at the institution. Garbage is removed from these houses twice daily to the piggery where it is fed to swine. Bones and some of the fats are rendered. Combustible rubbish is salvaged or burned. Noncombustible rubbish is disposed of on a dump on the bank of the river.

Recommendations

I. In regard to the water supply I recommend:

a That suitable fences be constructed around the area in the immediate vicinity of the springs to prevent inmates, employees, or trespassers from passing over any ground located less than 100 feet above or on either side of any spring or less than 50 feet below any spring.

b That ditches and embankments be constructed and maintained in condition effectively to prevent surface water from reaching the spring.

c That analyses of the water supply be made at frequent intervals to detect the presence of pollution.

2. In regard to the milk supply I recommend:

a That the dairy from which milk is purchased be regularly and frequently inspected.

b That the entire milk supply be pasteurized at the institution by approved methods.

3. In regard to sewers and sewage disposal I recommend:

a That the sewers be flushed at regular and frequent intervals.

b That a new sludge bed of suitable size be constructed at some point remote from the institution buildings and that the present sludge bed be abandoned.

c That the present sewer outfall be extended under the bed of the river to a point which will provide a submerged outfall at all times in the main channel.

d That the institution authorities consider the question of replacing the present sewage disposal plant by one of modern design, and that plans for such a plant be prepared and submitted to this Department for approval.

4. In regard to the disposal of refuse I recommend:

a That covers be provided for all barrels used in the collection of garbage and that these barrels be kept covered at all times.

BEACON (Matteawan State Hospital)

An investigation of the sanitary condition of the Matteawan State Hospital at Beacon, Dutchess county, was made by Mr. C. A. Howland, assistant engineer in this Department, on February 24 and 25, 1920. Previous investigations of the sanitary condition of the institution were made by this Department in 1915 (see page 995, Vol. II, of the 36th Annual Report) and in 1917 (see page 651, Vol. II, of the 38th Annual Report).

Location: City of Beacon, Dutchess county, N. Y.

Site of institution: The main buildings of the institution are situated on a hill about 1 mile north of the built-up sections of Beacon, and 1¾ miles east of the eastern bank of the Hudson river. The elevation of the ground at the main buildings is about 320 feet above the river, and the land slopes away from the buildings in all directions, affording adequate drainage. The soil is a sandy clay.

Area of grounds: 482.22 acres, of which about 396 are under cultivation.

Number of occupied buildings: 7.

Capacity: 549 men, 108 women, 220 officers and employees, total 877.

Present population: 782 men, 122 women, 185 officers and employees, total 1,089.

Class of inmates: Insane, committed by order of courts of criminal jurisdiction and convicted of petty crimes, not felons; persons becoming insane while undergoing sentence; also patients from other state hospitals who still exhibit criminal tendencies.

Water supply: The water supply of the institution is derived from 5 drilled wells located east and north of the main building and at a considerably lower elevation than the buildings. An 8-inch main also connects the institution water system with the public water supply system of the city of Beacon. The water from the city of Beacon is used principally in case of a breakdown in the institution supply. Each well is 8 inches in diameter and about 300 feet deep. The water is forced by air lift into a covered suction well from which it is pumped into two covered cisterns near the power house. From the cisterns water is pumped into the institution mains, the excess over consumption passing into a standpipe. The hardness of the water has been the source of trouble at the institution, particularly because of the scale which has formed extensively in the pipes of the hot and cold water systems.

Milk supply: The milk for the institution is obtained from the institution herd of 71 cows. The herd was tuberculin tested in March, 1919. Inmates are employed in milking. No provision is made for pasteurization of the milk.

Sewerage and sewage disposal: The sanitary sewage and storm water of the institution are collected in a system of combined sewers and discharged into the Hudson river without treatment. The sewers are flushed by means of flush tanks. The domestic sewage flows into a flush tank from which it is discharged by means of a siphon of the type having a movable reservoir trap hung on trunions, into the Hudson river at a point about 2½ miles above the Beacon station of the New York Central railroad.

Refuse disposal: Garbage is stored at the kitchens in barrels without covers. It is taken daily to the piggery and is fed to swine. Dust bins are provided on each ward, and the rubbish is collected daily and taken to a dump where the combustible rubbish is burned. Rags and papers are baled and sold.

Recommendations

1. That in view of the unsatisfactory conditions which exist in regard to the water supply of the institution, the authorities in charge of the institution consider as soon as practicable the matter of abandoning the present water supply and obtaining a supply sufficiently soft for the needs of the institution and of safe sanitary quality and adequate quantity.
2. That the institution authorities obtain an appropriation for and request the State Architect to prepare plans for the disposal of wash water and sewage from the milk house, such plans to be submitted to this Department for approval, as required by the Public Health Law.
3. That in view of the conditions surrounding the production of milk for the institution. the potentially infective character of milk, and the necessity of preventing the spread of infection from this source, arrangements be made effectively to pasteurize all the milk of the institution.
4. That the outfall sewer from the institution to the Hudson river be extended to such a point that unobstructed discharge of sewage into the river shall be obtained at all times.
5. That the storm water and sanitary sewage be separated, and that the sanitary sewage be given preliminary treatment before being discharged into the Hudson river.
6. That an additional pump of adequate capacity be installed in a separate, fire-proof building. and be directly connected to the water supply system for use in case of fire.

BEDFORD HILLS (State Reformatory for Women)

An investigation of the sanitary condition of the New York State Reformatory for Women at Bedford Hills, Westchester county, was made by Mr. C. A. Howland, assistant engineer in this Department, on February 26, 1920.

Previous investigations of the sanitary condition of the institution were made by this Department in 1911 (see page 964 of the 32nd Annual Report), in 1915 (see page 843, Vol. II, of the 36th Annual Report), and in 1917 (see page 632, Vol. II, of the 38th Annual Report). A special investigation of the water supply was made in 1919 (see page 122, Vol. II, of the 40th Annual Report), and special investigations of the sewage disposal plant were made in 1911 (see page 622 of the 32nd Annual Report), in 1916 (see page 776, Vol. II, of the 37th Annual Report), in 1917 (see page 658, Vol. II, of the 38th Annual Report), and in 1919 (see page 437, Vol. II, of the 40th Annual Report). Plans for water supply were approved on November 24, 1914; September 11, 1919; and September 17, 1920; and plans for sewerage and sewage disposal were approved on July 16, 1909; May 18, 1914; December 17, 1914; July 7, 1915; March 14, 1917; April 7, 1920; April 19, 1920; and July 9, 1920.

Location: About 1 mile northeast of Bedford Hills station, town of Bedford, Westchester county.

Site of institution: The buildings are all located on elevated ground bordering Broad brook which is a tributary of the Stone Hill river, and Croton lake of the New York city water supply.

Area of ground: 195.5 acres.

Number of occupied buildings: 31.

Capacity: 400 women, 123 officers and employees, total 523.

Present population: 289 women, 23 infants, 99 officers and employees, total 411

Class of inmates: The institution receives, upon commitment, delinquent females between the ages of 16 and 30 years who are not insane, or mentally or physically incapable of being substantially benefited by the discipline of such an institution.

Water supply: The original source of water supply for the institution was a brick well 20 feet in diameter and about 20 feet deep, located near the power house and about 30 feet west of Broad brook. A circular well 30 feet in diameter and 30 feet deep, located about 10 feet west of the first well and 60 feet from the brook, is also in use. An apparatus of the Wallace & Tiernan bubbling solution feed type for chlorination with liquid chlorine is used for the disinfection of the water. Plans were approved on September 11, 1919, for 3 wells, 2 inches in diameter, to be located on the side of the brook opposite the old wells, about 60 feet from it. At the time of the investigation the water supply was being pumped from the newer of the two original wells as much as possible, but when this well is drawn down so that water cannot be obtained from it, water is pumped from the old well. The water is pumped into an 80,000 gallon standpipe. An elevated tank is available but not used owing to the inadequacy of the present pumping equipment.

Milk supply: The milk supply is obtained partly by purchase and partly from the institution herd of 35 cows. The herd was tested for tuberculosis in February, 1920, and tubercular cows were disposed of. At the time of the inspection the cow barn was found to be carefully maintained, but because of the type of construction it cannot be considered satisfactory. The inmates do a large part of the milking. Although a bulk pasteurizer of about 50 gallons capacity has been installed, the milk is not pasteurized. In addition to about 250 quarts produced at the institution, 120 quarts per day of grade B raw milk from local dairies is purchased under a yearly contract.

Sewerage and sewage disposal: The sewage of the institution is collected in a system of sanitary sewers and conveyed to a sewage disposal plant consisting of a screen chamber, Imhoff tanks, dosing chambers, sand filters, sand catcher, chlorinating apparatus, and mixing chamber. An 8-inch main trunk sewer passes under Broad brook through two 8-inch castiron inverted siphons. Screenings from the screen chamber are placed on the sludge bed. During the summer only 2 of the 3 circular Imhoff tanks are used, but at the time of the inspection all were being operated in series. Four Miller siphons in each of 2 dosing tanks discharge the sewage in rotation onto either of 2 sand filters consisting of 4 beds each. After passing through the sand catcher the sewage is disinfected in the chlorinating building, in which are located 2 Wallace & Tiernan chlorinators of the manometer feed type.

Refuse disposal: Garbage is stored in covered galvanized iron cans. It is collected semiweekly and fed to swine. Combustible rubbish is burned in an incinerator, and noncombustible rubbish is placed on a dump.

Recommendations

1. That a water supply for the institution of adequate quantity and of safe sanitary quality be developed as soon as possible according to the plans approved by this Department, or approved amendments thereof.
2. That the surroundings of the present and the new wells be maintained in a sanitary condition, and that the chlorination of the water at a rate not less than 0.3 of a part by weight of chlorine per million parts of water treated be maintained at present and continued when the new wells are placed in service.
3. That scales be provided on which to rest the chlorine cylinders of the chlorinators at the power house, that the rate of application of the chlorine to the water be frequently checked by the scales, and that the rate of application of chlorine to the water be included in the reports made each month by the institution authorities to this Department.
4. That adequate pumping equipment be provided for the water supply of the institution.
5. That a properly designed and constructed cow barn be provided as soon as practicable.
6. That the drainage of the milk house be placed in sanitary operating condition, that the interior walls be painted, that screens be provided for the milk house, that the pails and cans be sterilized by a steam jet and placed to dry on a rack in an inverted position in the open air at a place where dust and dirt will not reach them, and that a proper cooler for the milk be provided.
7. That in view of the conditions surrounding the production of milk for the institution, the potentially infective character of milk, and the necessity of preventing the spread of infection from this source, arrangements be made to use only pasteurized milk at the institution, either by pasteurizing the milk produced at the institution and purchasing only pasteurized milk, or by pasteurizing both the institution milk and the purchased milk at the institution.
8. That permanent, level seats for the siphons of the dosing chamber of sewage filter beds 3, 4, 5, and 6 at the sewage disposal plant be provided, that the distributing troughs be repaired where necessary, and that the manometer of the chlorinator in use at the time of the inspection be repaired.

BINGHAMTON (State Hospital)

An investigation of the sanitary condition of the Binghamton State Hospital at Binghamton, Broome county, N. Y., was made by Mr. C. A. Howland, assistant engineer in this Department, on March 10 and 11, 1920. Previous investigations of the sanitary condition of the institution were made by this Department in 1915 (see page 896, Vol. II, of the 36th Annual Report) and in 1918 (see page 519, Vol. II, of the 39th Annual Report). A special investigation of the water supply was made in 1909 (see page 225, Vol. II, of the 30th Annual Report), and a special investigation of the sewerage system was made in 1915 (see page 226, Vol. II, of the 36th Annual Report). Plans for water supply were approved by this Department on August 25, 1911, and January 25, 1919; and plans for sewage disposal were approved on March 13, 1918.

Location: Binghamton, Broome county, N. Y.

Site of institution: The main buildings of the institution are located in the northeastern part of the city of Binghamton, on a hill about 200 feet above the Susquehanna river and 1,050 feet above mean sea level. Three farms owned by the State and operated in connection with the institution are situated on the northern bank of the Susquehanna river east of the principal buildings. The ground slopes are apparently sufficient to provide adequate drainage at the main group of buildings and the drainage of certain low areas at the farm is in progress.

Area of grounds: 1,363 acres.

Number of occupied buildings: About 30.

Capacity: 1,355 men, 1,045 women, 555 officers and employees, total 2,955.

Present population: 1,477 men, 1,226 women, 515 employees, total 3,218.

Class of inmates: All classes of insane expect the criminal insane.

Water supply: The principal water supply of the institution is derived from the Susquehanna river and wells. The intake from the river discharges into a subterranean infiltration gallery of masonry construction in the bottom of which are 9 flowing wells each about 6 inches in diameter and 12 feet deep. In addition to the wells in the infiltration gallery, there are 5 6-inch driven wells from which the water is pumped into the infiltration gallery. The water is filtered by gravity mechanical filters after coagulation with alum. After filtration the water is pumped into the mains of the institution, the excess of water pumped over water used going to a reservoir on the hill north of the institution buildings.

Milk supply: The milk supply for the institution is obtained partly by purchase and partly from the two institution herds. One herd consists of 96 cows which have not been tuberculin tested. The second herd consists of 46 cows which have been tuberculin tested and found to be healthy. In addition to about 2,300 quarts per day obtained from this herd, 300 quarts of grade B raw milk were being purchased from local milk dealers. The milk is pasteurized in a batch pasteurizer.

Sewerage and sewage disposal: The sewage of the main institution is collected by a system of combined sewers and is discharged into the Binghamton city sewerage system. Some stoppages have occurred from rags and other material put into the sewers by the patients. At a number of farm colonies and at the power house privies and cesspools are in use.

Refuse disposal: The garbage of the institution is stored in galvanized-iron cans at the several kitchens, from which it is collected daily and transported to a piggery where it is fed to swine. Rubbish is stored in open barrels, cans, or bins. Rags and papers are salvaged.

Recommendations

1. That the institution authorities consider the installation of a more adequate and suitable chlorinating apparatus to sterilize the effluent of the water filtration plant at all times.
2. That the matter of lining the reservoir at the main institution with a suitable water-tight material which may be more easily cleaned be considered by the institution authorities.
3. That a supply of water of safe sanitary quality be provided for Pine Camp, either by the purification of the river water or by obtaining water from some other source, and that this supply be connected to all fixtures of the camp from which it is possible to obtain water for drinking or culinary purposes.
4. That the pasteurizer be sterilized with steam before as well as after using.
5. That as previously recommended in our report of March 13, 1918, from an examination of the plans for a sewage pumping station at the power plant, the 5 wells outside the power house be abandoned and the lines from the wells to the pump be disconnected and capped before the sewage pumping plant is put in operation.
6. That inside toilet fixtures be installed at all the farm houses, and that satisfactory plans for suitable sewerage systems and sewage disposal plants for the farm houses and camp be prepared and submitted to this Department for approval.

7. That a sufficient number of receptacles fitted with suitable covers be provided for the storage of garbage and rubbish, that these receptacles be kept covered, and that the receptacles and their surroundings be maintained in a sanitary condition.

BUFFALO (State Institute for the Study of Malignant Diseases)

An investigation of the sanitary condition of the State Institute for the Study of Malignant Diseases at Buffalo, and the farm conducted in conjunction therewith at Springville, Erie county, was made by Mr. W. C. Emigh, assistant engineer in this Department, on June 29, 1920. Previous investigations of the sanitary condition of the institution were made by this Department in 1915 (see page 1027, Vol. II, of the 36th Annual Report) and in 1918 (see page 522, Vol. II, of the 39th Annual Report).

Location: The main buildings of the institution are located on High street, in the city of Buffalo. A farm comprising about 35 acres, maintained for use in connection with the institution and on which are kept such animals as are used in experimental pathology and research, is located about one mile east of the village of Springville, Erie county, N. Y.

Site of institution: The cottage and farm buildings are situated on elevated ground overlooking the road. The slope of the ground away from these buildings is steep and the terrain is in general of a rolling nature.

Area of farm grounds: 35 acres.

Number of occupied buildings at farm: 5, including barn and garage.

Water supply: The water supply of the main buildings of the institution located in the city of Buffalo is obtained from the mains of the public water supply of Buffalo. The water is filtered in apparatus installed by the Loomis-Manning Filter Distributing Company for the purpose of removing sediment and effecting a reduction in the turbidity of the water used at the main buildings. At the farm, the water supply is derived from a spring. Water flows from the spring to a hydraulic ram by which it is pumped into a pressure tank against compressed air.

Milk supply: The milk supply for the bacteriologist and his family, who are the only residents of the farm, is obtained from one cow and several goats.

Sewerage and sewage disposal: Sewage from the two houses at the farm is conducted to two sewage disposal plants, each consisting of a settling tank and a subsurface irrigation system.

Recommendations

1. That the institution authorities exercise such supervision as may be necessary to insure the maintenance at all times of proper sanitary conditions at and about the bungalow located near the spring.
2. That frequent analyses be made of the water from the spring, and should these analyses at any time indicate active contamination, a new supply of satisfactory quality be found and developed.
3. That plans be prepared and submitted to this Department showing details of construction of the two sewage disposal plants now in operation on the farm.

CENTRAL ISLIP (State Hospital)

An investigation of the Central Islip State Hospital at Central Islip, Suffolk county, was made by Mr. C. A. Howland, assistant engineer in this Department, on April 5 and 6, 1920. Previous examinations of the sanitary condition of the institution were made by this Department in 1914 (see page 915, Vol. II, of the 36th Annual Report), in 1916 (see page 643, Vol. II, of the 38th Annual Report), and in 1918 (see page 523, Vol. II, of the 39th Annual Report). Special investigations of the sewage disposal plant were made in 1907 (See page 744, Vol. II of the 28th Annual Report), and in 1910 (see page 490 of the 31st Annual Report). Plans for water supply were approved by this Department on July 17, 1916; August 11, 1919; November 6, 1919; and plans for sewerage were approved on August 12, 1918.

Location: Central Islip, Suffolk county, N. Y.

Site of institution: The hospital is situated in the central part of the town of Islip, about one mile south of the unincorporated village of Central Islip. The land in the vicinity is almost level. Its elevation above sea level averages about 60 feet. The top soil in the vicinity is of loam, mixed with sand and gravel overlying sand.

Area of grounds: 994 acres.

Number of occupied buildings: 129, 64 of which are used for housing patients.

Capacity: 2,369 men, 1,731 women, 875 employees, total 4,975.

Present population: 3,014 men, 2,520 women, 675 employees, total 6,209.

Class of inmates: All classes of insane except the criminal insane.

Water supply: The buildings of the institution are arranged in two separate groups known as the North and South colonies. Each of these groups has its own water system, and with the exception of a 4-inch line connecting the two which is used only in case of emergency, the systems are entirely separate. The water supply of the North colony is derived from 16 shallow and 2 deep wells located near the power house. The water supply of the South colony is derived from 22 shallow and 3 deep wells located similarly to those at the North colony. In view of the unsatisfactory location of the shallow wells, it was recommended in previous reports that a water supply from deep wells be developed as rapidly as possible and the shallow wells abandoned. As a result of these recommendations the 5 deep wells mentioned have been driven, and at the time of the inspection a third deep well was being driven at the North colony. A soft, rust-colored scale forms in the mains, especially at the refrigerating plant, and it is necessary to replace and clean the pipes at this place each year.

Milk supply: The milk used at the institution is obtained partially by purchase and partially from the institution herd of 29 cows. An average of 520 quarts of condensed milk and 560 quarts of fluid milk are purchased daily under a contract which specifies grade B raw milk. This milk is pasteurized after delivery at the institution. An average of 130 quarts of milk is produced by the institution herd. This milk is not pasteurized.

Sewerage and sewage disposal: The domestic sewage from the various buildings is collected by two separate sewerage systems, one serving the North colony and the other the South colony. The sewage of the two colonies is conveyed to sewage disposal plants consisting of screens, settling tanks, pumping plants, and broad irrigation fields. Almost the entire area of the field is covered with brush and small trees. It has been recommended by this Department in 1910, 1915, and 1917, that the entire sewage disposal plant of the institution be remodelled and arranged so that the sewage could be treated by sedimentation and intermittent sand filtration.

Refuse disposal: At the South colony garbage is placed directly in two metal-bodied cars mounted on railroad trucks in which it is taken to the piggery. At the North colony garbage is stored in cans and is collected and taken in wagons to the piggery where it is fed to swine. The rubbish is collected daily and burned in metal braziers erected at convenient points for this purpose, or is taken to a point near the reduction plant where it is buried in trenches. The meat bones were being dumped near a concrete block building in which had formerly been operated a reduction plant. The waste paper and rags from the institution are baled and sold. The scrap metal is also sold.

Recommendations

1. In view of the fact that the shallow wells at both colonies are so located as to be subject to pollution which may at any time become active, I would recommend:

(a) That the deep well supply be developed as rapidly as possible.

(b) That the deep wells be so located that it will be unnecessary for patients or others to pass over the ground near them.

(c) That trespassing be prohibited on the ground near the wells.

2. In regard to the disposal of the sewage of the hospital I would recommend:

(a) That a careful study be made of the problem of disposing of the sewage from the hospital, and satisfactory plans for a suitable sewage disposal plant be prepared by the State Architect either along the lines suggested in our report of 1910 or along other lines which as a result of a careful study of the situation may seem desirable.

(b) That such plans for satisfactory methods of sewage disposal when prepared be submitted to this Department for approval as required by the Public Health Law; and as soon as the plans are approved by this Department and financial and labor conditions warrant it, the construction of the sewage disposal plant be undertaken.

(c) That until such construction work can be carried out the present broad irrigation field, together with such extensions as may be made, be properly maintained and operated.

In order to accomplish this I would recommend:

(a) That the underbrush and weeds be removed from the area to which the sewage is applied, which area should be at least 50 acres in extent, and the ground be prepared by properly raking to receive the sewage.

(b) That suitable rest periods be allowed for each section of the area during which the surface should be scraped and raked.

3. In regard to the milk supply of the institution I would recommend:

(a) That the entire fluid milk supply of the institution, whether purchased or obtained from the institution herds, be effectively pasteurized.

(b) That the pasteurizer be sterilized with steam both before and after use.

(c) That means be provided effectively to sterilize the milk cans and utensils with steam.

4. In regard to refuse disposal I would recommend:

(a) That in view of the insanitary condition created by the present methods of disposing of the bones, a suitable platform or bin, properly screened, be provided for storing them until they are finally disposed of, that they be disposed of as rapidly as possible, and that the place of storage be maintained in a sanitary condition at all times.

(b) That an adequate number of receptacles for the storage of garbage and refuse be provided, that these receptacles be kept covered at all times, and that the receptacles and other surroundings be maintained in a sanitary condition.

COLLINS (Gowanda State Homeopathic Hospital)

An investigation of the sanitary condition of the Gowanda State Homeopathic Hospital, at Collins, Erie county, was made by Mr. Henry Ryon, assistant engineer in this Department, on January 19, 1920. Previous investigations of the sanitary condition of the institution were made by this Department in 1915 (see page 923, Vol. II, of the 36th Annual Report) and in 1917 (see page 644, Vol. II, of the 38th Annual Report).

Special investigations of the water supply were made in 1919 (see page 155, Vol. II, of the 40th Annual Report). Plans for water supply for the institution were approved by this Department on August 30, 1916.

Location: Town of Collins, Erie county, N. Y.

Site of institution: The institution is located on the Buffalo and Jamestown branch of the Erie railroad 13 miles south of Buffalo. The main buildings of the institution are on high ground lying between Clear creek and Cattaraugus creek. The former stream flows through the northeast part of the institution property, and the latter is about a mile and a quarter west of the main buildings.

Area of grounds: 700 acres.

Number of occupied buildings: 18, not including barns, stables, sheds, etc.

Certified capacity: Men 520, women 430, total 950.

Present population: Inmates, men 737, women 585, total 1,322; employees 200; total population, 1,522.

Class of inmates: Insane, except criminal insane, from the counties of Cattaraugus, Chautauqua, Erie, Wyoming, and those from other parts of the State for whom homeopathic treatment is desired.

Water supply: The water supply is obtained from two groups of springs located on opposite sides of the institution. The water from the group known as the Collins springs is collected in a concrete reservoir sunk in the ground just below them, and is raised from the basin to the main reservoir by an electrically driven centrifugal pump. The supply from the other group of springs, which is located on the Cattaraugus Indian reservation, is supplemented by the flow from a drilled well used as a down take for one of the air lifts which raise water from the springs to the main storage reservoir. The main reservoir into which the water from all the springs is discharged is an open rectangular basin having a capacity of approximately 1,000,000 gallons. It is apparent that the present supply is inadequate for the needs of the institution. The institution authorities are considering the development of a new source of supply, and to this end are sinking a test well on the flat near Cattaraugus creek, to the west of the institution. As a temporary expedient in order to provide a supply of water in case of fire, a pump has been installed near the Collins springs arranged to pump water from Clear creek into the receiving basin below the springs. The water from the main reservoir is pumped into the distribution system, the surplus going to a 110,000 gallon tank on a 100 foot tower.

Milk supply: The milk supply of the institution is obtained entirely from the institution herd of about 100 Holstein cows which have all been recently tuberculin tested. The cattle are kept in 3 stables, only 2 of which are of satisfactory construction. The cows are milked by patients. About 900 quarts of milk are produced daily, all of which is used raw.

Sewerage and sewage disposal: With the exception of the milk house all the buildings of the institution are served by a sewerage system which collects and conducts the sewage to a 20-inch combined sewer which discharges into Cattaraugus creek. The larger part of the sewers are arranged to keep the domestic and storm sewage separate; the trunk lines, however, carry combined sewage. The sewage from the milk-house is disposed of in a small plant consisting of settling tanks and a subsurface irrigation system.

Garbage and refuse disposal: The garbage from the institution is placed in covered galvanized iron cans and boxes at the main kitchen, and carted from there to the piggery twice a day where it is fed to the pigs. Infected garbage is burned on the dump, together with the inflammable refuse from the institution.

Recommendations

1. In regard to the water supply I would recommend:

(a) That on account of the obvious inadequacy of the yield of the present sources of supply and the possibility of the supply being accidentally or willfully polluted, a new source of supply of adequate quantity and unquestioned purity be developed without delay.

(b) That in view of the fact that the water of Clear creek is probably polluted, no water from this creek be pumped into the distribution system of the institution without first being sterilized.

2. In regard to the milk supply of the institution I would recommend:

(a) That additional stable facilities of suitable design be provided to relieve the present overcrowded condition, and that the building now used for the dry cows and young stock be remodeled to provide better light and ventilation.

(b) That all milk used at the institution be effectively pasteurized.

3. With reference to the sewage from the institution I would recommend that plans for the separation of the domestic and sanitary sewage, and the treatment of the domestic sewage in a suitable sewage disposal plant, be prepared by the State Architect and submitted to this Department for approval as required by section 14 of the Public Health Law.

4. In regard to the disposal of the garbage I would recommend that the wooden boxes used as garbage receptacles be replaced by galvanized iron cans fitted with suitable covers.

COMSTOCK (Great Meadow Prison)

An investigation of the sanitary condition of the Great Meadow Prison at Comstock, Washington county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on May 27 and 28, 1920. Previous investigations of the sanitary condition of this institution were made in 1915 (see page 999 of the 36th Annual Report) and in 1917 (see page 652, Vol. II, of the 38th Annual Report). A special investigation of the water supply was made in 1909 (see page 240, Vol. II, of the 30th Annual Report), and a special investigation of the sewage disposal plant was made in 1916 (see page 789, Vol. II, of the 37th Annual Report). Plans for water supply were approved on October 25, 1909, and plans for sewerage and sewage disposal were approved on February 8, 1910.

Location: Town of Fort Ann, Washington county, near the unincorporated village of Comstock.

Site of institution: The prison is situated on gently sloping land near and draining into the Champlain canal. It is within one-half mile of the main line of the Delaware & Hudson railroad.

Area of grounds: 1,164 acres.

Number of occupied buildings: 16.

Capacity: 1,168 male inmates.

Present population: 468 male inmates, 69 employees, total 537.

Class of inmates: Male felons transferred from other institutions.

Water supply: The principal water supply of the institution is obtained from Dolph pond which impounds the runoff from the wooded area located about 2 to 4 miles northwesterly of the institution. A small auxiliary supply used principally for drinking is obtained from an artesian well located under the mess hall. In view of the location of this well and the lack of information as to the precautions taken toward preventing pollution, it is again recommended that the use of the water from the well be discontinued entirely in favor of the supply from Dolph pond. Water from a spring is piped to the grounds of the warden's residence where it is used for drinking purposes. A pumping plant is located on the shore of the Champlain canal which could be used in case of extreme emergency to pump water from the canal. Inasmuch as it is known that the water of the Champlain canal is grossly polluted, this Department believes that any connection between the water mains of the institution and the canal provides a potential source of danger.

Milk supply: The milk supply is obtained from the institution herd of about 50 cows. Conditions in the cow barn were found to be fairly satisfactory, and inasmuch as a new cow barn and milk room are under construction and it is expected that they will be ready for use this year, it is not deemed necessary to make recommendations for possible improvements.

Sewerage and sewage disposal: The sanitary sewage is collected in a separate sewer system and conducted to a sewage disposal plant. The plant consists of 2 grease traps, 2 settling tanks of the vertical flow type, 2 sludge drying beds, and a battery of 4 intermittent sand filters with dosing apparatus. The entire plant was found to be in an insanitary, ineffective, and deplorable condition. As a result of the clogging of the inlet pipe, the first tank had been by-passed. Owing to the fact that the dosing apparatus of the filter beds was out of order, it was the practice to blow off the entire contents of the second tank onto the sludge bed at intervals of one or two days. The sludge beds are in need of a complete overhauling. In a past report it has been recommended that the area of the sand filter beds be doubled. At the time of the investigation sewage was standing on two of the four filter beds to a depth of several inches, thus indicating the clogged condition of the beds. The dike around one of the filter beds had broken away at a point adjacent to the outlet manhole so that sewage was found to be flowing over the top of the bed and directly into a stream. While our engineer was on the ground, the work of uncovering the lines of underdrains of the filter beds was started. Sand and sludge had worked through the spaces in the tile and the troughs were nearly full of muck and sludge. The dilution of the effluent in the stream was small.

Refuge disposal: Garbage is collected in galvanized iron receptacles and transported to the piggery where it is fed to swine. Rubbish containing no waste subject to decomposition is carried to a distant point on the institution grounds.

Recommendations

1. That the old lumber and debris be removed from the site of the camp employed in the work of cleaning the reservoir as mentioned in the body of the report.
2. That the use of water from the artesian well be discontinued, and the water from the Dolph pond supply used exclusively until such time as definite information may be submitted regarding details of construction of the well and safeguards against its pollution, but that the well be maintained in such condition that it may be used at any time as an emergency supply.
3. That the care now exercised in the preservation of the purity of the Dolph pond supply be continued, and that inspections be made of the reservoir and watershed at regular and frequent intervals to prevent or forestall the creation of any possible source of pollution.
4. That the connection now existing between the pumping plant located on the bank of the Champlain Canal and the mains of the institution water system be discontinued, and that if it is desired to maintain an emergency fire protection a separate main in no way connected with the mains of the Dolph pond supply be laid from this pumping plant to separate fire hydrants.
5. That plans be prepared by the State Architect and submitted to this Department for approval showing arrangements to be made for the sewerage of the new cow barn and milk room now under construction in order that same may be ready for operation at such date as the buildings are ready for occupancy.
6. That all milk used be pasteurized by approved methods.
7. That the sewage disposal plant be repaired and put in service in accordance with the following recommendations, many of which have already been included in previous reports:

    (a) That a screen chamber be installed as the first unit of the disposal plant, said screen to be so designed as to permit of easily raking the screenings onto a platform, and to be constructed in accordance with plans which should be prepared by the State Architect and receive the approval of this Department. That such a screen when placed in operation shall be cleaned daily, screenings to be disposed of in such a manner as not to create a nuisance or insanitary condition.

(b) That the sludge blowoff pipe of the first settling tank be cleaned, and if any structural defect is found to exist responsible for the persistent trouble experienced in the clogging of this pipe, that such defect be corrected.

(c) That a water pipe line be installed to the disposal plant and such connections made as will make possible the flushing out of the sludge blowoff pipes, the underdrains of the filters, and the cleaning of the settling tanks when necessary.

(d) That definite steps be taken to prevent the entrance of ashes and sand through any manhole or other sewer openings.

(e) That the sag in the sludge pipe crossing the brook bed be corrected and provision be made for the trussing of the pipe at this point, or other suitable means of support.

(f) That the sludge drying beds be thoroughly overhauled, which shall include —

(1) The removal of all grass from surface.

(2) Repair of dikes, protecting same with sheet piling if necessary.

(3) Thorough overhauling of the underdrainage system and installation of an underdrainage system in the smaller bed.

(4) Cleaning or removal of the sand as may prove necessary.

(5) Division of the larger bed into two beds.

(6) Installation of new distributing trough with facilities for running the sludge onto any single bed thus permitting better operation of same.

(g) That the siphons be overhauled, preferably by a representative of the manufacturer, and placed in such condition that their positive action and control is assured at all times, and that in the future at least three beds be used at all times, dosing to be in rotation by their respective siphons. If it is not possible to obtain satisfactory results with these siphons, that they be replaced by new siphons or by some other satisfactory type of siphon.

(h) That the same filter beds be thoroughly overhauled and repaired in the following respects:

(1) That the book tile of the drains be removed and cleaned.

(2) That the concrete troughs of the drains be cleaned.

(3) That the tile be relayed with ½-inch open joints.

(4) That gravel or broken stone be placed around the tile to a depth of 6 inches above the concrete troughs and extending a distance of at least 6 inches each side of the tile.

(5) That intermediate underdrains, properly covered with graded gravel, be placed between the existing underdrains.

(6) That the sand from the top of the bed be removed to a depth of 4 to 6 inches or more as may be necessary to arrive at a fairly clean sand, and that same be replaced with new sand.

(7) That the concrete wall around a portion of the beds now in bad state of repair be rebuilt and strenghtened as may be necessary to protect the beds from wash at times of high water and from slumping of adjacent clay soil onto the bed.

(8) That new distributing troughs be constructed or the old ones be placed in proper condition.

(9) That the fresh air vents be straightened and increased in height sufficient to avoid all possibility of any part of the sewage discharged onto the bed flowing directly through them to the underdrain.

(10) That if the number of inmates of the institution increase materially beyond the present population the beds be increased in size proportionally.

(i) That after the completion of the various changes enumerated above, careful and particular attention be given to the operation of the plant.

(j) That plans showing details of changes and additions made to the sand filter beds, not included in the original plans approved by this Department, be submitted for approval.

8. That the existing privy at the baseball field be abandoned and a privy of the removable container type, located further from the highway, be substituted for it.

9. That an effort be made to obtain galvanized iron garbage cans with suitable covers at the earliest possible date.

DANNEMORA (Clinton Prison and Dannemora State Hospital)

An investigation of the sanitary condition of Clinton Prison and Dannemora State Hospital, both located at Dannemora, Clinton county, was made by Mr. W. C. Emigh, assistant engineer in this Department, on June 1 and 2, 1920. Previous investigations of the sanitary condition of the institutions were made by this Department in 1915 (see page 1006 of the 36th Annual Report) and in 1917 (see page 653, Vol. II, of the 38th Annual Report). A special investigation of the water supply was made in 1918 (see page 197, Vol. II, of the 39th Annual Report). Plans for sewerage and sewage disposal were approved on January 28, 1910.

Location: Village of Dannemora, Clinton county.

Site of institutions: The institutions are situated at the foot of a mountain in the northern part of the village of Dannemora, and are reached from Plattsburg over the Plattsburg and Lake Placid branch of the Delaware and Hudson railroad. The natural drainage of the site is good.

Area of grounds: In the vicinity of the institution the prison owns 625 acres, but considerable other land in the surrounding country is owned or controlled by the prison. About 10 acres are included within the prison stockade. The area of the State Hospital lands is 134 acres.

Capacity: Clinton Prison, 1,600 male inmates. Dannemora State Hospital, 458 male inmates.

Present population: Clinton Prison, 960 men, 150 employees, total 1,110. Dannemora State Hospital, 520 men, 115 employees, total 635.

Class of inmates: Clinton Prison, male convicts. Dannemora State Hospital, criminally insane male convicts.

Number of occupied buildings: Clinton Prison, 16. Dannemora State Hospital, 10.

Clinton Prison

Water supply: The water supply of the prison consists of a principal supply from impounded surface streams and a number of auxiliary ground water supplies. There are two reservoirs on the main supply known as the upper and lower reservoirs, having capacities of about 1,500,000 and 1,000,000 gallons respectively. The reservoirs are located on a hill in the rear of the prison. At times this main supply is inadequate and resort is had to other sources. In the main prison inclosure there is an 8-inch driven well, 285 feet deep. On the elevated ground near the new tuberculosis hospital there is located a well originally sunk as a mine shaft to a depth of about 100 feet. There is a small covered concrete tank or basin located a short distance below this well or shaft which apparently receives the overflow from the latter. A socalled east line spring is located on another watershed and is piped into a plastered brick reservoir located below the cow barn. Another source of water supply used in the past and the use of which was discontinued owing to the freezing of the pipes last winter, is derived from an old abandoned mine. The water mains of the prison are also connected with the Dannemora village water mains and water from the village supply is occasionally used.

Milk supply: The milk supply is obtained principally from a herd of cows belonging to the prison, which at the time of the investigation numbered 35 head of cattle. The milking is done by inmates of the prison. A new milk room has been constructed. The milk is used without pasteurization.

Sewerage and sewage disposal: The sewerage system of the institution consists of lateral sewers, a trunk sewer, a screen chamber, and 4 settling tanks. As originally planned, the sewer system was designed to carry some storm water as well as sanitary sewage, but it appears that all storm water has now been eliminated from the system. The screen is of improper design, lacking in facilities for cleaning. At several points on the trunk sewer between the screen chamber and the settling tank, breaks in the sewer had occurred. At such points wooden boxes with removable covers had been built over the sewer which had not been otherwise repaired. The settling tank consists of 4 units operated in pairs and each pair operated in series. The sludge blow-offs were clogged. The effluent from the tank flows into a small stream which discharges into the Saranac river at a point about 5 miles distant.

Refuse disposal: Garbage is collected in wooden barrels without covers and conveyed to the piggery where it is fed to swine. Combustible rubbish is burned. Noncombustible rubbish is placed on a dump.

Dannemora State Hospital

Water supply: The water supply of the Dannemora State Hospital is obtained from the mains of the Clinton Prison system. The hospital has for some time had funds available for the purchase of a tract of land located on a mountain in the rear of the present property. There is a possibility that if this land were purchased by the State a water supply might be developed thereon, with suitable storage reservoirs sufficient to nearly if not entirely furnish the water supply of the hospital.

Milk supply: Approximately 25 per cent of the milk supply is obtained from the herd of 12 cows owned by the institution. The remainder is purchased from a local dairy. Neither the milk produced at the institution nor the purchased milk is pasteurized.

Sewerage and sewage disposal: The sewage of the hospital is discharged into the sewers of Clinton Prison.

Refuse disposal: Garbage is collected in wooden barrels and is fed to swine. Combustible rubbish is burned, and noncombustible rubbish is placed on a dump.

Recommendations

Clinton Prison:

1. In regard to water supply:

   (a) That at the earliest possible date a thorough investigation be undertaken of possible sources of a new or additional water supply of adequate quantity and satisfactory sanitary quality, and that plans for such additional or new water supply be prepared by the State Architect and submitted to this Department for approval.

   (b) That steps be taken properly to protect the mines or shafts from pollution due to surface wash, or that the use of water therefrom be discontinued entirely.

   (c) That no water be used from the driven well until sources of of pollution are removed or the safe quality of water is assured.

   (d) That ice cutting on reservoirs used for water supplies be discontinued.

2. In regard to the milk supply:

   (a) That the milk be pasteurized by approved methods.
   (b) That milking be done in small-top pails.
   (c) That a drain be installed in the floor of the milk room.

3. In regard to the sewerage and sewage disposal:

(a) That a new screen chamber be provided under plans which should be prepared by the State Architect and submitted to and receive the approval of this Department. The screen should be so designed as to permit of easily raking the screenings onto a platform, and when placed in operation it should be cleaned daily and such disposal made of the screenings as not to create a nuisance or menace to health.

(b) That the storm water sewer be cleaned at the point now clogged near the present screen chamber, and that the connection between the screen chamber and the manhole on the storm water sewer be broken.

(c) That all breaks in the line of sewer be properly repaired.

(d) That at the point where the sewer now forms an open pond, such construction be undertaken as shall entirely correct this condition.

(e) That the settling tanks be thoroughly cleaned and that the sludge blow-off pipes be cleaned and kept in operating condition.

(f) That sludge drying beds be constructed of proper design, location, and capacity, from plans which shall have been approved by this Department.

(g) That plans for more complete treatment of the sewage of the institution be prepared and submitted for approval, and that the works provided by such plans be installed at as early a date as practicable.

4. In regard to the refuse disposal and general sanitation:

(a) That galvanized iron garbage barrels or cans with covers be supplied, and that after each emptying these barrels or cans be washed with hot water.

(b) That the intended removal of the piggery from its present location near the new tuberculosis hospital be effected as soon as possible.

Dannemora State Hospital:

1. That the hospital authorities cooperate with the prison authorities as far as possible in the investigation of and securing of necessary appropriations for a satisfactory joint supply of water.

2. In regard to the milk supply:

(a) That the institution authorities continue to make every effort possible to procure an appropriation for the erection of a new and modern cow barn, and to acquire sufficient additional pasturage to justify them in substantially increasing the hospital herd; and that until such time as this may be accomplished every effort be made to keep the quality of milk as safe as possible under existing conditions.

(b) That at the farm of Mr. Phillips such regulations regarding the handling of milk be enforced as are required of those who are selling milk in cities of this State.

(c) That milk be pasteurized at the hospital by approved methods.

3. That the institution be provided with galvanized iron garbage barrels or cans with covers, and that same be cleaned with hot water after each emptying.

FARMINGDALE (State Institute of Applied Agriculture)

An investigation of the sanitary conditions of the State Institute of Applied Agriculture at Farmingdale, Suffolk county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on July 8, 1920. A previous investigation of the sanitary condition of this institution was made by this Department in 1917 (see page 630, Vol. II, of the 38th Annual Report); a special investigation of the water supply of the institution was made in 1915 (see page 1029, Vol. II, of the 36th Annual Report); and a special investigation of the sewage disposal plant was made in 1916 (see page 793, Vol. II, of the 37th Annual Report). Plans for water supply, sewerage and sewage disposal were approved on July 10, 1914; December 24, 1914; and May 29, 1915.

Location: On the boundary line of the town of Oyster Bay, Nassau county, and the town of Babylon, Suffolk county.

Nature of institution: A school for instruction in agriculture.

Area of grounds: 308 acres.

Site of institution: The school is situated about 1½ miles north of the village of Farmingdale which is on the main line of the Long Island railroad, about 33 miles from the Pennsylvania Railroad Station in New York city. The central portion of the school property is flat, the main drainage being from hills in the northeastern part of the property toward the southwest. The ground surface drops sharply to the Amityville–Huntington highway.

Number of occupied buildings: 7, exclusive of barns and other farm and accessory buildings.

Capacity: Boys 188, girls 20, employees 60, total 268. Present accommodations permit about half of the students to live on the grounds.

Present population: Boys 157, girls 6; total enrollment 163; employees 55; total population 218. It is expected that the incoming class will bring the total enrollment in the fall to the present capacity of the school.

Class of inmates: Students in agriculture.

Water supply: The main source of the institution water supply is an 8-inch driven well 111 feet deep. From the well water is raised by air lift to a covered concrete reservoir which is located near the power house. From the reservoir water is pumped to an elevated steel tank located about 2,000 feet from the power house, with a capacity of approximately 50,000 gallons. The water supply for two farm houses located on the institution property is derived from wells. From the bottom of a dug well at the Ruland farm a pipe has been driven to a depth 10 feet greater, from which depth water is raised. At the Seaman farm a new well has been driven about 40 feet deep and located 12 feet from the house.

Milk supply: The milk supply of the institution is obtained from the institution herd which numbered 29 at the time of the investigation. The herd was tuberculin tested in March, 1920. Milk is used without pasteurization.

Sewerage and sewage disposal: The surface water and sanitary sewage is collected in separate systems of sewers. Sewage is conveyed to a disposal plant consisting of coarse screens, settling tanks, a chlorination plant, and a subsurface irrigation field. The sewage after passing through the screens flows into a sump from which it is pumped to the settling tanks of which there are 3 of the Imhoff type. A sludge press which was installed in the pump house has never operated satisfactorily. Privies are in use at the Ruland and Seaman farm houses.

Refuse disposal: Garbage is removed from the kitchen daily and is fed to swine. Rubbish is burned on a dump. Paper is burned under the power house boilers.

Recommendations

1. In regard to the water supply:

   (a) That the practice of throwing wash water on the ground in the vicinity of the wells at the Ruland and Seaman farms be discontinued.

   (b) That the old well chamber at the Ruland farm be filled with earth at least as fine as that of the surrounding ground.

2. In regard to the milk supply:

   That the milk produced at the institution be pasteurized by approved methods.

3. In regard to the sewerage and sewage disposal:

(a) That the ground around the manholes of the sanitary sewers be so graded as to preclude the possibility of surface water entering these sewers.

(b) That the automatic float control switches intended to operate the sewage pumps be removed to a location sufficiently dry to permit of satisfactory operation of this apparatus.

(c) That the baffles of the settling tanks be repaired or reconstructed.

(d) That in view of the failure of the sludge press to operate, plans be prepared and submitted to this Department showing a suitable sludge drying bed, together with method to be employed for the placing of the sludge from the settling tanks thereon, and that such beds be constructed at an early date.

(e) That the chlorinating apparatus be repaired or replaced at the earliest possible date.

(f) That the clogging of the subsurface irrigation field or leakage from the distribution mains be properly remedied.

(g) That the present privies at the Ruland and Seaman farm houses be replaced by fly proof privies of the removable container type located not less than 100 feet from the wells; and that provisions be made to conduct the wash water from these houses to properly located and designed cesspools.

FIRE ISLAND (State Park)

An investigation of the sanitary condition of the Fire Island State Park at Fire Island, Suffolk county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on September 1, 1920. Previous examinations of the sanitary condition of the park were made by this Department in 1914 (see page 1032, Vol. II, of the 36th Annual Report). A special investigation of the water supply of the institution was made in 1917 (see page 340, Vol. II, of the 37th Annual Report). Plans for water supply and sewerage and sewage disposal were approved on April 23, 1912.

Location: Fire Island, town of Islip, county of Suffolk, N. Y.

Site of institution: The park is situated on Fire Island, which lies at this point about 5 miles off the south shore of Long Island. It is located some 2 miles from Fire Island inlet, and about 6 miles from Bay Shore, from which it is reached by boat. The park extends from the Great South bay on the north shore of the island to the Atlantic ocean on the south shore.

Area of grounds: 120 acres.

Number of occupied buildings: Four cottages and a swimming pavilion. The permanent population through the summer consists of 4 or 5 employees and their families. The visiting population is said to average about 300 people per day through the months of July and August.

Water supply: The main source of water supply is from a dug well 5 feet deep located near the center of the park property. Water is raised from the well by a pump installed on the first floor of the building over the well to a tank located on the second floor. From the tank water is piped to several buildings on the park property. A shallow driven well located about 200 feet from an employee's cottage is used as a source of supply by the occupants of the cottage. A shallow driven well near the main boardwalk fitted with a pitcher pump was not in operating condition at the time of the investigation.

Sewerage and sewage disposal: Plans which were approved by this department for sewerage and sewage disposal show one large cesspool at the public toilet building and two smaller ones at the bathing pavilion. The public toilet building was destroyed by fire in 1917, and subsequently a large privy has been in use. The cesspools at the bathing pavilion were functioning properly. Two additional cesspools for which no plans had been submitted

to this Department have been constructed to care for the sewage from the park commissioner's cottage and the superintendent's cottage.

Refuse disposal: **The garbage and rubbish, of which the greater part is left by picnic parties, is picked up by park employees and thrown into the waters of Great South bay.**

Recommendations

1. In regard to water supply:

   (a) That the present well be filled in and a new well be constructed at a distance from the pumping plant of not less than 50 feet, the water to be drawn therefrom by the pumping equipment as located at present, and that this new well be adequately protected against contamination.

   (b) That fences be constructed inclosing an area not less than 100 feet square about each well, and that the public be excluded from the inclosed area.

2. In regard to the disposal of sewage:

   That all privies be abandoned, and water closets be provided where needed.

3. In regard to refuse disposal:

   That all garbage be buried, and all other combustible rubbish be burned at a suitable point and in such a manner as not to create a nuisance.

INDUSTRY (State Agricultural and Industrial School)

An investigation of the sanitary condition of the State Agricultural and Industrial School at Industry, Monroe county, was made by Mr. C. A. Howland, assistant engineer in this Department, on March 25, 1920. Previous investigations of the sanitary condition at the institution were made by this Department in 1911 (see page 988 of the 32nd Annual Report), in 1914 (see page 479, Vol. II, of the 35th Annual Report), and in 1918 (see page 525, Vol. II, of the 39th Annual Report). A special investigation of the sewage disposal plant was made in 1919 (see page 444, Vol. II, of the 40th Annual Report). Plans for water supply were approved on October 19, 1910; and plans for sewage disposal were approved on June 5, 1911.

Location: Industry, town of Rush. Monroe county, N. Y.

Site of institution: The institution is situated in the valley of the Genesee river, about 14 miles southwest of the city of Rochester. The grounds of the institution rise from an elevation of 530 feet above mean sea level at the river, to an elevation of about 620 feet at a point about one mile east of the river. The Rochester branch of the Erie railroad passes through the property, and the Industry station on that line is located near the main buildings of the institution.

Area of grounds: 1,432 acres.

Number of occupied buildings: About 50.

Capacity: 755 boys, 178 officers and employees, total 933.

Class of inmates: Male children between the ages of 12 and 16 years who shall be legally committed to such school by any court having authority to make such commitment.

Water supply: The water supply of the institution is taken from the municipal supply of the city of Rochester. An 8-inch pipe connects the 6-inch main distribution line of the institution with the Rush reservoir of the city water supply, and a connection also exists with the supply main from Hemlock lake to the city of Rochester.

Milk supply: The milk supply is obtained from 10 separate herds of cows maintained at the different colonies on the institution property. All cows have been tuberculin tested and are free from tuberculosis. The daily pro-

duction of milk at the time of the inspection was about 3,500 pounds. After as much milk as is needed for use at the colonies is distributed, the remainder is separated; butter is made from the cream and the skimmed milk is returned to the cottages. In the majority of cases the barns were found to be in a satisfactory condition of repair and to be carefully maintained.

Sewerage and sewage disposal: All of the occupied buildings of the institution are provided with toilet fixtures and the sewage is collected by several separate sewerage systems. Manholes have not been provided at every change of grade and alignment and trouble has been experienced with stoppages in some cases. Plans approved by this Department on June 6, 1911, show that the sewage of the institution is to be disposed of by means of 7 separate sewage disposal plants. Five of these plants have been constructed. All of the plants are of the same general type, each consisting of a settling tank, dosing tank, and sand filter. In 3 instances trenches are provided for the final disposal of the sludge. At the time of the inspection the sewage disposal plants were not in a satisfactory operating condition, and it appears that they have not been constructed entirely in accordance with the plans approved by this Department.

Refuse disposal: The garbage is stored in covered galvanized iron pails and is fed to hogs which are kept near many of the cottages. Combustible rubbish is burned, and noncombustible rubbish is placed on a dump.

Recommendations

1. That in view of the conditions surrounding the production of milk at the institution, the potentially infective character of milk, and the necessity of preventing the spread of infection from this source, arrangements be made effectively to pasteurize all the milk of the institution.
2. That the sewage disposal plants be reconstructed wherever necessary to conform to the plans approved by this Department.
3. That the sewage disposal plants be properly repaired wherever necessary and be operated efficiently throughout the entire year.
4. That all connections for the discharge of surface or roof water into the sanitary sewers be disconnected, and this water be discharged through properly constructed storm sewers into appropriate water courses.
5. That proper sewage disposal be provided in accordance with the plans approved by this Department or approved amendments thereof, for those buildings which are without sewage disposal.

IROQUOIS (Thomas Indian School)

An investigation of the sanitary condition of the Thomas Indian School at Iroquois, Erie county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on June 30, 1920. Previous examinations of the sanitary condition of the institution were made by this Department in 1911 (see page 996 of the 32nd Annual Report), and in 1914 (see page 850, Vol. II, of the 36th Annual Report), and in 1918 (see page 526, Vol. II, of the 39th Annual Report). A special investigation of the water supply of the institution was made in 1919. Plans showing certain details of additional water supply were approved on July 2, 1920, and July 27, 1920.

Location: Iroquois, Cattaraugus Indian Reservation, Erie county, N. Y.

Site of institution: The institution is situated in the valley of Cattaraugus creek, about 8 miles east of Lake Erie. The elevation of the ground at the site of the buildings is 650 feet above mean sea level, and about 80 feet above the level of Lake Erie. The nearest railroad station is Lawtons, which is on the Buffalo and Southwestern division of the Erie railroad, 27 miles south of Buffalo.

Area of grounds: 100 acres. An additional 165 acres is rented.

Number of occupied buildings: 11, not including barn, shop, and power house.

Capacity: 90 boys, 100 girls, 51 employees, total 241.

Present population: 95 boys, 100 girls, 49 employees, total 244.

Class of inmates: Destitute and orphan Indian children from any of the several Indian reservations in the State of New York.

Water supply: Four sources of water supply are available at the institution, of which 3 are in normal use. Water from a spring located on a steep hillside at a distance of about 1¼ miles from the institution buildings flows by gravity to the institution property. Two wells are in use, both of which are located in close proximity to the institution buildings. The newer well has but recently been placed in use, and at the time of the investigation water was pumped from this well by means of a temporary connection. A pond just east of the main buildings furnishes an auxiliary supply for fire protection. The pond is fed by surface water which is unquestionably polluted and unfit for domestic use.

Milk supply: The milk supply of the institution is obtained from the institution herd of 30 cows. The herd was tuberculin tested during the month of May, 1920. A new milk house has recently been constructed. The building is of brick, and in the basement are installed refrigeration and ice manufacturing plants. The milk room and two coolers are located on the main floor. The milk is used without pasteurization.

Sewerage and sewage disposal: The sewage of the institution is collected by a system of combined sewers and discharged without treatment into Cattaraugus creek, which stream empties into Lake Erie about 25 miles southwest of the city of Buffalo.

Garbage and refuse disposal: The garbage is removed from the kitchen after each meal to the piggery where it is fed to swine. Rubbish is placed on a dump.

Recommendations

1. In regard to water supply:

(a) That the permanent pumping equipment of the new well be installed and placed in operation at the earliest possible date.

(b) That provision be made for the deflection of the surface water from the vicinity of both the old and the new well, and that protection of the wells from trespassers be effected by fencing off the area around them as outlined in the body of this report.

(c) That in view of the fact that the present arrangement of piping near the pumps makes it possible for polluted water from the pond near the school building to be turned into the distribution system carrying the domestic water supply, and that in case of a large fire it would probably be necessary to use the same pumps which normally handle the domestic supply for pumping the polluted pond water, I would recommend that either the domestic and fire supplies be entirely separated, including the installation of a pump to be used for fire purposes only, or that an additional supply of pure water be developed and the use of the pond as an auxiliary source of supply be abandoned.

2. In regard to the milk supply:

(a) That in view of the conditions which exist in the old milk-room and the difficulty with which these conditions could be satisfactorily remedied, the new milk room be equipped and placed in use at the earliest possible date.

(b) That the milk used at the institution be pasteurized in accordance with approved methods.

3. In regard to disposal of sewage:

That the question of treating the domestic sewage in a suitable plant before it is discharged into the creek be considered by the institution authorities, and that plans for the necessary changes in the sewerage system and for a suitable disposal plant be prepared and submitted to this Department for approval.

4. In regard to garbage disposal:

That the garbage be removed from the vicinity of the kitchen promptly after each meal.

KINGS PARK (State Hospital)

An investigation of the sanitary condition of the Kings Park State Hospital at Kings Park, Suffolk county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on July 9 and August 30, 1920. Previous investigations of the sanitary condition of the institution were made by this Department in 1915 (see page 934, Vol. II, of the 36th Annual Report), in 1917 (see page 645, Vol. II, of the 38th Annual Report), and in 1919 (see page 425, Vol II, of the 40th Annual Report). Special investigations of the sewage disposal plant were made in 1916 (see page 666, Vol. II, of the 38th Annual Report), in 1918 (see page 546, Vol II, of the 39th Annual Report), and in 1919 (see page 446, Vol. II, of the 40th Annual Report). Plans for water supply were approved on August 31, 1915; August 22, 1918; and March 19, 1920; and plans for sewerage and sewage disposal were approved on December 29, 1908; July 28, 1912; and July 3, 1917.

Location: Kings Park, Suffolk county, Long Island, on the Wading River branch of the Long Island railroad, about 40 miles from New York city.

Site of institution: The institution is situated upon rolling ground on the shores of Smithtown bay, just west of the mouth of the Nissequoque river. The institution buildings are on ground well elevated above the bay, and the slope of the surface is such as to afford adequate natural drainage. The soil is sandy. The buildings are located about 1 mile from the north shore line of Long Island.

Area of grounds: 834.61 acres.

Number of occupied buildings: 63.

Capacity: Men 1,564, women 1,936; total inmates 3,500; employees 845; total capacity population, 4,345. A new cottage building now in construction will accommodate about 200.

Present population: Men 2,006, women 2,691; total inmates 4,697; employees 676; total present population, 5,373.

Class of inmates: All classes of insane except the criminal insane.

Water supply: The water supply of the institution is obtained from a battery of 10 deep wells located near the power house. The wells are driven through alternate strata of sand and clay and are said to average about 490 feet in depth. Water is raised from the wells to a sump by air lift. From the sump the water is pumped to an open reservoir at a distance of about 4,000 feet from the power house. The elevation of the reservoir is not sufficient to provide water for the buildings of group No. 1, and it is therefore necessary to employ a booster pump to supply these buildings. If the depth of water in the reservoir is increased beyond 6 feet, the rate of leakage equals the rate of pumping. Plans have been approved by this Department for a new reservoir at a greater elevation, but owing to lack of funds the construction had not been commenced at the time of the investigation.

Milk supply: A part of the milk supply is obtained from the institution herd of 52 head of cattle. The herd is tuberculin tested annually. Milking is done by inmates. In addition to the milk produced by the institution herd, 1,000 quarts of grade B pasteurized milk and 240 quarts of condensed milk are purchased daily. The milk produced at the institution is used without pasteurization.

Sewerage and sewage disposal: The sanitary sewage and storm water from the institution are for the most part collected in separate sewers. The sewage is conducted to a disposal plant consisting of coarse screens, settling tanks, a dosing tank, sprinkling filter, disinfection apparatus, final settling tanks, and sludge drying beds. A portion of the sewer between the main screen chamber and the settling tanks consists of duplicate lines of an inverted siphon. The settling tanks, the construction of one of which had not been completed at the time of the investigation, are of the Imhoff type. The distribution of settled sewage on the surface of the sprinkling filter is not satisfactory. A cesspool is provided to care for the sewage from the residence of the supervisor of the grounds.

Refuse disposal: A concrete garbage house is provided near each of the five main kitchens at the institution. Garbage is collected from these houses and transported to the piggery where it is fed to swine. Rubbish is burned in a wire cage in the woods beyond the piggery. Rags and papers are salvaged.

Recommendations

1. In regard to the water supply:

That added storage of sufficient capacity to furnish water at adequate pressure for fire protection be provided.

2. In regard to milk supply:

That all milk produced at the institution be pasteurized by approved methods.

3. In regard to sewerage and sewage disposal:

(a) That such recommendations of the report of this Department dated August 18, 1919, on a special investigation of the sewage disposal plant, as have not been carried out be complied with at the earliest possible date.

(b) That the nozzles now in use for the distribution of sewage on the sprinkling filter be replaced by nozzles throwing a broader spray, or that an additional distribution main for the sprinkling filter be installed, or that other means be found to overcome a sufficient portion of the loss of head now occurring in the existing distribution system to effect a better distribution of sewage.

(c) That the toilet at the piggery and the sewer leading therefrom be installed at the earliest possible date.

4. In regard to disposal of refuse:

(a) That care be exercised to keep all barrels used for the collection of garbage covered at all times.

(b) That the doors of the garbage house be kept closed.

(c) That the floors of the garbage house be washed daily.

(d) That as little garbage and bones as possible be stored at the piggery, and that such quantities as it may be necessary to store be covered and rendered inaccessible to flies.

MIDDLETOWN (State Homeopathic Hospital)

An investigation of the sanitary condition of the State Homeopathic Hospital at Middletown, Orange county, was made by Mr. C. A. Howland, assistant engineer in this Department, on January 30, 1920. Previous investigations of the sanitary condition of the institution were made by this Department in 1915 (see page 940, Vol. II, of the 36th Annual Report) and in 1918 (see page 527, Vol. II, of the 39th Annual Report).

Location: Middletown, Orange county.

Site of institution: The main buildings of the institution are located on elevated ground in the northwestern part of the city of Middletown. The surface of the ground slopes away from the main group of buildings in all directions, affording good drainage; and the drainage of the other parts of the institution property is apparently good.

Area of grounds: 540 acres.

Number of occupied buildings: 23.

Capacity: 616 men, 1,224 women, 475 employees, total 2,315.

Present population: 759 men, 1,334 women, 367 employees, total 2,460.

Class of inmates: Insane except criminal insane, from the counties of Orange, Rockland, Sullivan, and Ulster, and patients from any part of the State for whom homeopathic treatment is desired.

Water supply: The entire water supply of the institution is obtained from the public water supply of the city of Middletown, which is derived from two sources, namely, Highland lake and Monhegan lake. The wells which were previously used at the institution and which were found to be subject to contamination have been abandoned, in accordance with the recommendations of this Department. The city water supplies from both sources are treated by coagulation and are filtered, the water from Highland lake through pressure mechanical filters and that from Monhegan lake through gravity mechanical filters. The higher buildings are supplied from the Monhegan lake (lower pressure supply) by pumping, and the lower buildings are supplied directly from the Highland mains. The systems are separate, except for a cross connection at the power house, which is ordinarily kept closed. The water is pumped into an iron storage tank of 9,355 gallons capacity located in the tower of the main building, and into a similar tank of 6,840 gallons capacity located at a lower elevation in pavilion 1.

Milk supply: The milk supply is obtained partially by purchase and partially from the institution herd. Raw milk is purchased under a contract from local dealers of Middletown or vicinity. During 1919 an average of 1,080 quarts per day was so purchased. The institution herd, which at the time of the inspection consisted of 93 cows, was tested for tuberculosis in September, 1919, and the tubercular cattle were killed. The milking is done by hand twice a day, and inmates are employed in this work. A 300-gallon pasteurizer of the batch type is installed in the creamery room at the main building. The pasteurizer was not in use at the time of the inspection, and had not been used since May 5, 1919, because no ice was available for cooling the milk after pasteurization. When the equipment is used, both the purchased milk and the milk produced at the institution are pasteurized.

Sewerage and sewage disposal: The sanitary sewage of the main part of the institution is collected by a system of sanitary sewers and discharged into city sewers in West Main street and Monhegan avenue. The sewage from the power house, the kitchen sinks, and toilet of the kitchen building of the west group is conveyed to a pumping plant near the power house. A detritus chamber is located near the greenhouse, in the West Main street sewer. A cesspool has been constructed for the disposal of the sewage from the florist's cottage. A second cesspool has been provided at the contagious cottage for sewage from the bathtub and sink. The sewage from about 30 people at the Comfort farm is discharged into a tight metal settling tank from which it flows into a subsurface irrigation system.

Refuse disposal: Garbage is stored in galvanized iron cans from which it is collected daily and taken to the piggery where it is fed to swine. Rubbish is collected daily and placed on a dump, where the combustible rubbish is burned in an open fire. Rags and papers are salvaged and sold.

Recommendations

1. That all the milk used at the institution be properly pasteurized, and that the recommendations of the report of this Department of February 11, 1918 in regard to the methods of operating the pasteurizer, be carried out.

2. That a thorough study be made of the existing sewerage system of the institution, and that plans be prepared showing the existing sewerage system and sewage disposal works with such modifications and alterations

as may be necessary to provide a comprehensive system of sewerage and sewage disposal works for the entire institution, and that this study be made at once in order that the sewage of the east group may be satisfactorily incorporated.

3. That the garbage and rubbish cans be kept covered at all times.

MORRISVILLE (State School of Agriculture)

An investigation of the sanitary condition of the New York State School of Agriculture at Morrisville, Madison county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on June 18, 1920. Previous examinations of the sanitary condition of this institution were made by this Departcent in 1910 (see page 748, Vol. II, of the 32nd Annual Report), in 1914 (see page 1035, Vol. II, of the 36th Annual Report), and in 1918 (see page 529, Vol. II, of the 39th Annual Report). Plans for water supply were approved on October 20, 1914; and plans for sewerage and sewage disposal were approved on August 31, 1911, and January 20, 1919.

Location: Village of Morrisville, Madison county, N. Y.

Site of institution: The village of Morrisville lies in the valley of Callahan brook about 2½ miles west of the Morrisville station of the New York, Ontario and Western railroad. The institution is situated in the eastern part of the village, occupying the original county buildings of the county of Madison. The elevation of the ground at the main institution buildings is about 40 feet above the brook and about 1,320 feet above mean sea level. On each side of the valley the hills rise to an elevation of about 1,700 feet above sea level.

Area of grounds: 250 acres.

Number of occupied buildings: 5, not including the barns and accessory buildings.

Capacity: 200 students of both sexes.

Present population: 64 men, 15 women, 26 employees; total, 105. It is anticipated by the school authorities that the enrollment of the incoming class in the fall will increase the total student body to approximately 125. Of this number only a small proportion, about 10 per cent, live on the institution grounds.

Class of inmates: Students in agriculture.

Water supply: The water supply of the institution is derived largely from 3 springs located on property owned by the institution at a distance of about one-half mile from the main school buildings. Water from the spring chambers flows by gravity to a covered concrete storage reservoir, and from the reservoir to the school buildings. In addition to this source of supply, the municipal supply of the village of Morrisville is connected with the institution system in the cellars of several of the buildings. The village supply is derived from a reservoir located about one mile west of the village, which is largely fed by springs, and in addition receives surface drainage from a considerable area.

Milk supply: The institution owns a herd of 13 milch cows which had been tuberculin tested a few weeks previous to the investigation. Since very few of the students live at the school, only a small portion of the milk produced by the herd is consumed there. The milk is not pasteurized.

Sewerage and sewage disposal: Sewage from the main buildings of the institution is conducted through a coarse screen chamber to the sewage disposal plant, which consists of a settling tank, a dosing chamber, and a subsurface irrigation field. A second sewage disposal plant has been provided near the dairy barn to care for the drainage from the fixtures in the barn, the milk room, and administration building. The plant is located under a driveway and is completely buried. As shown on the plans, the plant consists of a circular concrete cesspool or settling tank and a subsurface irrigation field.

Refuse disposal: Such small amounts of garbage as result from the meals prepared at the dormitory are removed daily by a farmer residing a short distance from the school. Refuse and ashes are used to fill in low ground.

Recommendations

1. In regard to the water supply:

(a) That the institution authorities consider the matter of purchasing additional land to the north and east of the institution springs in order better to protect the supply from possible contamination due to the pollution of the surface of the ground in the vicinity.

(b) That diverting ditches be constructed as outlined in the body of this report designed to convey surface wash from the adjoining property away from the springs.

(c) That the open spring be protected with a closed concrete screen chamber.

(d) That a lock be provided for the present collecting basin and that the basin be kept locked at all times.

(e) That as far as possible the institution supply be used for all purposes with the exception of boiler feed water.

2. In regard to the sewage disposal plant:

(a) That the drainage system be uncovered at the point where sewage now appears on the surface, and that such repairs be made as shall prove necessary to remedy that condition.

(b) That the vents of the subsurface irrigation system be repaired and maintained in proper condition.

(c) That the valves now covered be unearthed and the valve boxes be replaced.

(d) That the automatic dosing siphon be maintained in operating condition at all times.

NAPANOCH (Eastern New York Reformatory)

An investigation of the sanitary condition of the Eastern New York Reformatory at Napanoch, Ulster county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on July 6, 1920. Previous examinations of the sanitary condition of this institution were made by this Department in 1911 (see page 1003 of the 32nd Annual Report), in 1914 (see page 480, Vol. II, of the 35th Annual Report), in 1918 (see page 530, Vol. II, of the 39th Annual Report), and in 1919 (see page 426, Vol. II, of the 40th Annual Report). Plans for sewerage and sewage disposal were approved on September 27, 1912, and February 28, 1913.

Location: At Napanoch, Wawarsing township, Ulster county, N. Y.

Site of institution: The reformatory is situated on a flat area east of Rondout creek nearly opposite the village of Napanoch and at the foot of the Shawangung mountains. The institution grounds are about 280 feet above sea level and slope gently toward the creek. To the east the land rises steeply to an elevation of 2,200 feet, the institution property extending up this slope to an elevation of 1,200 feet. The soil in the vicinity is sandy and apparently well drained.

Area of grounds: 312 acres, of which 57 acres are tillable.

Number of occupied buildings: 8, including barn.

Capacity: 496 male inmates, 44 employees, total 540.

Present population: 205 male inmates, 40 employees, total 245.

Class of inmates: Males between the ages of 16 and 30 convicted of a felony, who have not been previously convicted of any crime punishable by imprisonment in a state prison. The institution receives the surplus population of the State Reformatory at Elmira, in connection with which it is maintained.

Water supply: The water supply of the institution is obtained from a small reservoir formed by a concrete dam across a narrow valley located on a mountain side in the rear of the reformatory. The watershed tributary to the reservoir has an area of about three-quarters square mile, is unpopu-

as may be necessary to provide a comprehensive system of sewerage and sewage disposal works for the entire institution, and that this study be made at once in order that the sewage of the east group may be satisfactorily incorporated.

3. That the garbage and rubbish cans be kept covered at all times.

MORRISVILLE (State School of Agriculture)

An investigation of the sanitary condition of the New York State School of Agriculture at Morrisville, Madison county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on June 18, 1920. Previous examinations of the sanitary condition of this institution were made by this Departcent in 1910 (see page 748, Vol. II, of the 32nd Annual Report), in 1914 (see page 1035, Vol. II, of the 36th Annual Report), and in 1918 (see page 529, Vol. II, of the 39th Annual Report). Plans for water supply were approved on October 20, 1914; and plans for sewerage and sewage disposal were approved on August 31, 1911, and January 20, 1919.

***Location:* Village of Morrisville, Madison county, N. Y.**

***Site of institution:* The village of Morrisville lies in the valley of Callahan brook about 2½ miles west of the Morrisville station of the New York, Ontario and Western railroad. The institution is situated in the eastern part of the village, occupying the original county buildings of the county of Madison. The elevation of the ground at the main institution buildings is about 40 feet above the brook and about 1,320 feet above mean sea level. On each side of the valley the hills rise to an elevation of about 1,700 feet above sea level.**

***Area of grounds:* 250 acres.**

***Number of occupied buildings:* 5, not including the barns and accessory buildings.**

***Capacity:* 200 students of both sexes.**

***Present population:* 64 men, 15 women, 26 employees; total, 105. It is anticipated by the school authorities that the enrollment of the incoming class in the fall will increase the total student body to approximately 125. Of this number only a small proportion, about 10 per cent, live on the institution grounds.**

***Class of inmates:* Students in agriculture.**

***Water supply:* The water supply of the institution is derived largely from 3 springs located on property owned by the institution at a distance of about one-half mile from the main school buildings. Water from the spring chambers flows by gravity to a covered concrete storage reservoir, and from the reservoir to the school buildings. In addition to this source of supply, the municipal supply of the village of Morrisville is connected with the institution system in the cellars of several of the buildings. The village supply is derived from a reservoir located about one mile west of the village, which is largely fed by springs, and in addition receives surface drainage from a considerable area.**

***Milk supply:* The institution owns a herd of 13 milch cows which had been tuberculin tested a few weeks previous to the investigation. Since very few of the students live at the school, only a small portion of the milk produced by the herd is consumed there. The milk is not pasteurized.**

***Sewerage and sewage disposal:* Sewage from the main buildings of the institution is conducted through a coarse screen chamber to the sewage disposal plant, which consists of a settling tank, a dosing chamber, and a subsurface irrigation field. A second sewage disposal plant has been provided near the dairy barn to care for the drainage from the fixtures in the barn, the milk room, and administration building. The plant is located under a driveway and is completely buried. As shown on the plans, the plant consists of a circular concrete cesspool or settling tank and a subsurface irrigation field.**

***Refuse disposal:* Such small amounts of garbage as result from the meals prepared at the dormitory are removed daily by a farmer residing a short distance from the school. Refuse and ashes are used to fill in low ground.**

Recommendations

1. In regard to the water supply:

(a) That the institution authorities consider the matter of purchasing additional land to the north and east of the institution springs in order better to protect the supply from possible contamination due to the pollution of the surface of the ground in the vicinity.

(b) That diverting ditches be constructed as outlined in the body of this report designed to convey surface wash from the adjoining property away from the springs.

(c) That the open spring be protected with a closed concrete screen chamber.

(d) That a lock be provided for the present collecting basin and that the basin be kept locked at all times.

(e) That as far as possible the institution supply be used for all purposes with the exception of boiler feed water.

2. In regard to the sewage disposal plant:

(a) That the drainage system be uncovered at the point where sewage now appears on the surface, and that such repairs be made as shall prove necessary to remedy that condition.

(b) That the vents of the subsurface irrigation system be repaired and maintained in proper condition.

(c) That the valves now covered be unearthed and the valve boxes be replaced.

(d) That the automatic dosing siphon be maintained in operating condition at all times.

NAPANOCH (Eastern New York Reformatory)

An investigation of the sanitary condition of the Eastern New York Reformatory at Napanoch, Ulster county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on July 6, 1920. Previous examinations of the sanitary condition of this institution were made by this Department in 1911 (see page 1003 of the 32nd Annual Report), in 1914 (see page 480, Vol. II, of the 35th Annual Report), in 1918 (see page 530, Vol. II, of the 39th Annual Report), and in 1919 (see page 426, Vol. II, of the 40th Annual Report). Plans for sewerage and sewage disposal were approved on September 27, 1912, and February 28, 1913.

Location: At Napanoch, Wawarsing township, Ulster county, N. Y.

Site of institution: The reformatory is situated on a flat area east of Rondout creek nearly opposite the village of Napanoch and at the foot of the Shawangung mountains. The institution grounds are about 280 feet above sea level and slope gently toward the creek. To the east the land rises steeply to an elevation of 2,200 feet, the institution property extending up this slope to an elevation of 1,200 feet. The soil in the vicinity is sandy and apparently well drained.

Area of grounds: 312 acres, of which 57 acres are tillable.

Number of occupied buildings: 8, including barn.

Capacity: 496 male inmates, 44 employees, total 540.

Present population: 205 male inmates, 40 employees, total 245.

Class of inmates: Males between the ages of 16 and 30 convicted of a felony, who have not been previously convicted of any crime punishable by imprisonment in a state prison. The institution receives the surplus population of the State Reformatory at Elmira, in connection with which it is maintained.

Water supply: The water supply of the institution is obtained from a small reservoir formed by a concrete dam across a narrow valley located on a mountain side in the rear of the reformatory. The watershed tributary to the reservoir has an area of about three-quarters square mile, is unpopu-

to this Department have been constructed to care for the sewage from the park commissioner's cottage and the superintendent's cottage.

Refuse disposal: The garbage and rubbish, of which the greater part is left by picnic parties, is picked up by park employees and thrown into the waters of Great South bay.

Recommendations

1. In regard to water supply:

   (a) That the present well be filled in and a new well be constructed at a distance from the pumping plant of not less than 50 feet, the water to be drawn therefrom by the pumping equipment as located at present, and that this new well be adequately protected against contamination.

   (b) That fences be constructed inclosing an area not less than 100 feet square about each well, and that the public be excluded from the inclosed area.

2. In regard to the disposal of sewage:

   That all privies be abandoned, and water closets be provided where needed.

3. In regard to refuse disposal:

   That all garbage be buried, and all other combustible rubbish be burned at a suitable point and in such a manner as not to create a nuisance.

INDUSTRY (State Agricultural and Industrial School)

An investigation of the sanitary condition of the State Agricultural and Industrial School at Industry, Monroe county, was made by Mr. C. A. Howland, assistant engineer in this Department, on March 25, 1920. Previous investigations of the sanitary condition at the institution were made by this Department in 1911 (see page 988 of the 32nd Annual Report), in 1914 (see page 479, Vol. II, of the 35th Annual Report), and in 1918 (see page 525, Vol. II, of the 39th Annual Report). A special investigation of the sewage disposal plant was made in 1919 (see page 444, Vol. II, of the 40th Annual Report). Plans for water supply were approved on October 19, 1910; and plans for sewage disposal were approved on June 5, 1911.

Location: Industry, town of Rush. Monroe county, N. Y.

Site of institution: The institution is situated in the valley of the Genesee river, about 14 miles southwest of the city of Rochester. The grounds of the institution rise from an elevation of 530 feet above mean sea level at the river, to an elevation of about 620 feet at a point about one mile east of the river. The Rochester branch of the Erie railroad passes through the property, and the Industry station on that line is located near the main buildings of the institution.

Area of grounds: 1,432 acres.

Number of occupied buildings: About 50.

Capacity: 755 boys, 178 officers and employees, total 933.

Class of inmates: Male children between the ages of 12 and 16 years who shall be legally committed to such school by any court having authority to make such commitment.

Water supply: The water supply of the institution is taken from the municipal supply of the city of Rochester. An 8-inch pipe connects the 6-inch main distribution line of the institution with the Rush reservoir of the city water supply, and a connection also exists with the supply main from Hemlock lake to the city of Rochester.

Milk supply: The milk supply is obtained from 19 separate herds of cows maintained at the different colonies on the institution property. All cows have been tuberculin tested and are free from tuberculosis. The daily pro-

duction of milk at the time of the inspection was about 3,500 pounds. After as much milk as is needed for use at the colonies is distributed, the remainder is separated; butter is made from the cream and the skimmed milk is returned to the cottages. In the majority of cases the barns were found to be in a satisfactory condition of repair and to be carefully maintained.

Sewerage and sewage disposal: All of the occupied buildings of the institution are provided with toilet fixtures and the sewage is collected by several separate sewerage systems. Manholes have not been provided at every change of grade and alignment and trouble has been experienced with stoppages in some cases. Plans approved by this Department on June 6, 1911, show that the sewage of the institution is to be disposed of by means of 7 separate sewage disposal plants. Five of these plants have been constructed. All of the plants are of the same general type, each consisting of a settling tank, dosing tank, and sand filter. In 3 instances trenches are provided for the final disposal of the sludge. At the time of the inspection the sewage disposal plants were not in a satisfactory operating condition, and it appears that they have not been constructed entirely in accordance with the plans approved by this Department.

Refuse disposal: The garbage is stored in covered galvanized iron pails and is fed to hogs which are kept near many of the cottages. Combustible rubbish is burned, and noncombustible rubbish is placed on a dump.

Recommendations

1. That in view of the conditions surrounding the production of milk at the institution, the potentially infective character of milk, and the necessity of preventing the spread of infection from this source, arrangements be made effectively to pasteurize all the milk of the institution.
2. That the sewage disposal plants be reconstructed wherever necessary to conform to the plans approved by this Department.
3. That the sewage disposal plants be properly repaired wherever necessary and be operated efficiently throughout the entire year.
4. That all connections for the discharge of surface or roof water into the sanitary sewers be disconnected, and this water be discharged through properly constructed storm sewers into appropriate water courses.
5. That proper sewage disposal be provided in accordance with the plans approved by this Department or approved amendments thereof, for those buildings which are without sewage disposal.

IROQUOIS (Thomas Indian School)

An investigation of the sanitary condition of the Thomas Indian School at Iroquois, Erie county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on June 30, 1920. Previous examinations of the sanitary condition of the institution were made by this Department in 1911 (see page 996 of the 32nd Annual Report), and in 1914 (see page 850, Vol. II, of the 36th Annual Report), and in 1918 (see page 526, Vol. II, of the 39th Annual Report). A special investigation of the water supply of the institution was made in 1919. Plans showing certain details of additional water supply were approved on July 2, 1920, and July 27, 1920.

Location: Iroquois, Cattaraugus Indian Reservation, Erie county, N. Y.

Site of institution: The institution is situated in the valley of Cattaraugus creek, about 8 miles east of Lake Erie. The elevation of the ground at the site of the buildings is 650 feet above mean sea level, and about 80 feet above the level of Lake Erie. The nearest railroad station is Lawtons, which is on the Buffalo and Southwestern division of the Erie railroad, 27 miles south of Buffalo.

(b) That in view of the fact that the water of Clear creek is probably polluted, no water from this creek be pumped into the distribution system of the institution without first being sterilized.

2. In regard to the milk supply of the institution I would recommend:

(a) That additional stable facilities of suitable design be provided to relieve the present overcrowded condition, and that the building now used for the dry cows and young stock be remodeled to provide better light and ventilation.

(b) That all milk used at the institution be effectively pasteurized.

3. With reference to the sewage from the institution I would recommend that plans for the separation of the domestic and sanitary sewage, and the treatment of the domestic sewage in a suitable sewage disposal plant, be prepared by the State Architect and submitted to this Department for approval as required by section 14 of the Public Health Law.

4. In regard to the disposal of the garbage I would recommend that the wooden boxes used as garbage receptacles be replaced by galvanized iron cans fitted with suitable covers.

COMSTOCK (Great Meadow Prison)

An investigation of the sanitary condition of the Great Meadow Prison at Comstock, Washington county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on May 27 and 28, 1920. Previous investigations of the sanitary condition of this institution were made in 1915 (see page 999 of the 36th Annual Report) and in 1917 (see page 652, Vol. II, of the 38th Annual Report). A special investigation of the water supply was made in 1909 (see page 240, Vol. II, of the 30th Annual Report), and a special investigation of the sewage disposal plant was made in 1916 (see page 789, Vol. II, of the 37th Annual Report). Plans for water supply were approved on October 25, 1909, and plans for sewerage and sewage disposal were approved on February 8, 1910.

Location: Town of Fort Ann, Washington county, near the unincorporated village of Comstock.

Site of institution: The prison is situated on gently sloping land near and draining into the Champlain canal. It is within one-half mile of the main line of the Delaware & Hudson railroad.

Area of grounds: 1,164 acres.

Number of occupied buildings: 16.

Capacity: 1,168 male inmates.

Present population: 468 male inmates, 69 employees, total 537.

Class of inmates: Male felons transferred from other institutions.

Water supply: The principal water supply of the institution is obtained from Dolph pond which impounds the runoff from the wooded area located about 2 to 4 miles northwesterly of the institution. A small auxiliary supply used principally for drinking is obtained from an artesian well located under the mess hall. In view of the location of this well and the lack of information as to the precautions taken toward preventing pollution, it is again recommended that the use of the water from the well be discontinued entirely in favor of the supply from Dolph pond. Water from a spring is piped to the grounds of the warden's residence where it is used for drinking purposes. A pumping plant is located on the shore of the Champlain canal which could be used in case of extreme emergency to pump water from the canal. Inasmuch as it is known that the water of the Champlain canal is grossly polluted, this Department believes that any connection between the water mains of the institution and the canal provides a potential source of danger.

Milk supply: The milk supply is obtained from the institution herd of about 50 cows. Conditions in the cow barn were found to be fairly satisfactory, and inasmuch as a new cow barn and milk room are under construction and it is expected that they will be ready for use this year, it is not deemed necessary to make recommendations for possible improvements.

Sewerage and sewage disposal: The sanitary sewage is collected in a separate sewer system and conducted to a sewage disposal plant. The plant consists of 2 grease traps, 2 settling tanks of the vertical flow type, 2 sludge drying beds, and a battery of 4 intermittent sand filters with dosing apparatus. The entire plant was found to be in an insanitary, ineffective, and deplorable condition. As a result of the clogging of the inlet pipe, the first tank had been by-passed. Owing to the fact that the dosing apparatus of the filter beds was out of order, it was the practice to blow off the entire contents of the second tank onto the sludge bed at intervals of one or two days. The sludge beds are in need of a complete overhauling. In a past report it has been recommended that the area of the sand filter beds be doubled. At the time of the investigation sewage was standing on two of the four filter beds to a depth of several inches, thus indicating the clogged condition of the beds. The dike around one of the filter beds had broken away at a point adjacent to the outlet manhole so that sewage was found to be flowing over the top of the bed and directly into a stream. While our engineer was on the ground, the work of uncovering the lines of underdrains of the filter beds was started. Sand and sludge had worked through the spaces in the tile and the troughs were nearly full of muck and sludge. The dilution of the effluent in the stream was small.

Refuge disposal: Garbage is collected in galvanized iron receptacles and transported to the piggery where it is fed to swine. Rubbish containing no waste subject to decomposition is carried to a distant point on the institution grounds.

Recommendations

1. That the old lumber and debris be removed from the site of the camp employed in the work of cleaning the reservoir as mentioned in the body of the report.
2. That the use of water from the artesian well be discontinued, and the water from the Dolph pond supply used exclusively until such time as definite information may be submitted regarding details of construction of the well and safeguards against its pollution, but that the well be maintained in such condition that it may be used at any time as an emergency supply.
3. That the care now exercised in the preservation of the purity of the Dolph pond supply be continued, and that inspections be made of the reservoir and watershed at regular and frequent intervals to prevent or forestall the creation of any possible source of pollution.
4. That the connection now existing between the pumping plant located on the bank of the Champlain Canal and the mains of the institution water system be discontinued, and that if it is desired to maintain an emergency fire protection a separate main in no way connected with the mains of the Dolph pond supply be laid from this pumping plant to separate fire hydrants.
5. That plans be prepared by the State Architect and submitted to this Department for approval showing arrangements to be made for the sewerage of the new cow barn and milk room now under construction in order that same may be ready for operation at such date as the buildings are ready for occupancy.
6. That all milk used be pasteurized by approved methods.
7. That the sewage disposal plant be repaired and put in service in accordance with the following recommendations, many of which have already been included in previous reports:

    (a) That a screen chamber be installed as the first unit of the disposal plant, said screen to be so designed as to permit of easily raking the screenings onto a platform, and to be constructed in accordance with plans which should be prepared by the State Architect and receive the approval of this Department. That such a screen when placed in operation shall be cleaned daily, screenings to be disposed of in such a manner as not to create a nuisance or insanitary condition.

(b) That the sludge blowoff pipe of the first settling tank be cleaned, and if any structural defect is found to exist responsible for the persistent trouble experienced in the clogging of this pipe, that such defect be corrected.

(c) That a water pipe line be installed to the disposal plant and such connections made as will make possible the flushing out of the sludge blowoff pipes, the underdrains of the filters, and the cleaning of the settling tanks when necessary.

(d) That definite steps be taken to prevent the entrance of ashes and sand through any manhole or other sewer openings.

(e) That the sag in the sludge pipe crossing the brook bed be corrected and provision be made for the trussing of the pipe at this point, or other suitable means of support.

(f) That the sludge drying beds be thoroughly overhauled, which shall include —

(1) The removal of all grass from surface.

(2) Repair of dikes, protecting same with sheet piling if necessary.

(3) Thorough overhauling of the underdrainage system and installation of an underdrainage system in the smaller bed.

(4) Cleaning or removal of the sand as may prove necessary.

(5) Division of the larger bed into two beds.

(6) Installation of new distributing trough with facilities for running the sludge onto any single bed thus permitting better operation of same.

(g) That the siphons be overhauled, preferably by a representative of the manufacturer, and placed in such condition that their positive action and control is assured at all times, and that in the future at least three beds be used at all times, dosing to be in rotation by their respective siphons. If it is not possible to obtain satisfactory results with these siphons, that they be replaced by new siphons or by some other satisfactory type of siphon.

(h) That the same filter beds be thoroughly overhauled and repaired in the following respects:

(1) That the book tile of the drains be removed and cleaned.

(2) That the concrete troughs of the drains be cleaned.

(3) That the tile be relayed with ½-inch open joints.

(4) That gravel or broken stone be placed around the tile to a depth of 6 inches above the concrete troughs and extending a distance of at least 6 inches each side of the tile.

(5) That intermediate underdrains, properly covered with graded gravel, be placed between the existing underdrains.

(6) That the sand from the top of the bed be removed to a depth of 4 to 6 inches or more as may be necessary to arrive at a fairly clean sand, and that same be replaced with new sand.

(7) That the concrete wall around a portion of the beds now in bad state of repair be rebuilt and strenghtened as may be necessary to protect the beds from wash at times of high water and from slumping of adjacent clay soil onto the bed.

(8) That new distributing troughs be constructed or the old ones be placed in proper condition.

(9) That the fresh air vents be straightened and increased in height sufficient to avoid all possibility of any part of the sewage discharged onto the bed flowing directly through them to the underdrain.

(10) That if the number of inmates of the institution increase materially beyond the present population the beds be increased in size proportionally.

(i) That after the completion of the various changes enumerated above, careful and particular attention be given to the operation of the plant.

(j) That plans showing details of changes and additions made to the sand filter beds, not included in the original plans approved by this Department, be submitted for approval.

8. That the existing privy at the baseball field be abandoned and a privy of the removable container type, located further from the highway, be substituted for it.

9. That an effort be made to obtain galvanized iron garbage cans with suitable covers at the earliest possible date.

DANNEMORA (Clinton Prison and Dannemora State Hospital)

An investigation of the sanitary condition of Clinton Prison and Dannemora State Hospital, both located at Dannemora, Clinton county, was made by Mr. W. C. Emigh, assistant engineer in this Department, on June 1 and 2, 1920. Previous investigations of the sanitary condition of the institutions were made by this Department in 1915 (see page 1006 of the 36th Annual Report) and in 1917 (see page 653, Vol. II, of the 38th Annual Report). A special investigation of the water supply was made in 1918 (see page 197, Vol. II, of the 39th Annual Report). Plans for sewerage and sewage disposal were approved on January 28, 1910.

Location: Village of Dannemora, Clinton county.

Site of institutions: The institutions are situated at the foot of a mountain in the northern part of the village of Dannemora, and are reached from Plattsburg over the Plattsburg and Lake Placid branch of the Delaware and Hudson railroad. The natural drainage of the site is good.

Area of grounds: In the vicinity of the institution the prison owns 625 acres, but considerable other land in the surrounding country is owned or controlled by the prison. About 10 acres are included within the prison stockade. The area of the State Hospital lands is 134 acres.

Capacity: Clinton Prison, 1,600 male inmates. Dannemora State Hospital, 458 male inmates.

Present population: Clinton Prison, 960 men, 150 employees, total 1,110. Dannemora State Hospital, 520 men, 115 employees, total 635.

Class of inmates: Clinton Prison, male convicts. Dannemora State Hospital, criminally insane male convicts.

Number of occupied buildings: Clinton Prison, 16. Dannemora State Hospital, 10.

Clinton Prison

Water supply: The water supply of the prison consists of a principal supply from impounded surface streams and a number of auxiliary ground water supplies. There are two reservoirs on the main supply known as the upper and lower reservoirs, having capacities of about 1,500,000 and 1,000,000 gallons respectively. The reservoirs are located on a hill in the rear of the prison. At times this main supply is inadequate and resort is had to other sources. In the main prison inclosure there is an 8-inch driven well, 285 feet deep. On the elevated ground near the new tuberculosis hospital there is located a well originally sunk as a mine shaft to a depth of about 100 feet. There is a small covered concrete tank or basin located a short distance below this well or shaft which apparently receives the overflow from the latter. A socalled east line spring is located on another watershed and is piped into a plastered brick reservoir located below the cow barn. Another source of water supply used in the past and the use of which was discontinued owing to the freezing of the pipes last winter, is derived from an old abandoned mine. The water mains of the prison are also connected with the Dannemora village water mains and water from the village supply is occasionally used.

Milk supply: The milk supply is obtained principally from a herd of cows belonging to the prison, which at the time of the investigation numbered 35 head of cattle. The milking is done by inmates of the prison. A new milk room has been constructed. The milk is used without pasteurization.

Sewerage and sewage disposal: The sewerage system of the institution consists of lateral sewers, a trunk sewer, a screen chamber, and 4 settling tanks. As originally planned, the sewer system was designed to carry some storm water as well as sanitary sewage, but it appears that all storm water has now been eliminated from the system. The screen is of improper design, lacking in facilities for cleaning. At several points on the trunk sewer between the screen chamber and the settling tank, breaks in the sewer had occurred. At such points wooden boxes with removable covers had been built over the sewer which had not been otherwise repaired. The settling tank consists of 4 units operated in pairs and each pair operated in series. The sludge blow-offs were clogged. The effluent from the tank flows into a small stream which discharges into the Saranac river at a point about 5 miles distant.

Refuse disposal: Garbage is collected in wooden barrels without covers and conveyed to the piggery where it is fed to swine. Combustible rubbish is burned. Noncombustible rubbish is placed on a dump.

Dannemora State Hospital

Water supply: The water supply of the Dannemora State Hospital is obtained from the mains of the Clinton Prison system. The hospital has for some time had funds available for the purchase of a tract of land located on a mountain in the rear of the present property. There is a possibility that if this land were purchased by the State a water supply might be developed thereon, with suitable storage reservoirs sufficient to nearly if not entirely furnish the water supply of the hospital.

Milk supply: Approximately 25 per cent of the milk supply is obtained from the herd of 12 cows owned by the institution. The remainder is purchased from a local dairy. Neither the milk produced at the institution nor the purchased milk is pasteurized.

Sewerage and sewage disposal: The sewage of the hospital is discharged into the sewers of Clinton Prison.

Refuse disposal: Garbage is collected in wooden barrels and is fed to swine. Combustible rubbish is burned, and noncombustible rubbish is placed on a dump.

Recommendations

Clinton Prison:

1. In regard to water supply:

    (a) That at the earliest possible date a thorough investigation be undertaken of possible sources of a new or additional water supply of adequate quantity and satisfactory sanitary quality, and that plans for such additional or new water supply be prepared by the State Architect and submitted to this Department for approval.

    (b) That steps be taken properly to protect the mines or shafts from pollution due to surface wash, or that the use of water therefrom be discontinued entirely.

    (c) That no water be used from the driven well until sources of of pollution are removed or the safe quality of water is assured.

    (d) That ice cutting on reservoirs used for water supplies be discontinued.

2. In regard to the milk supply:

    (a) That the milk be pasteurized by approved methods.
    (b) That milking be done in small-top pails.
    (c) That a drain be installed in the floor of the milk room.

3. In regard to the sewerage and sewage disposal:

(a) That a new screen chamber be provided under plans which should be prepared by the State Architect and submitted to and receive the approval of this Department. The screen should be so designed as to permit of easily raking the screenings onto a platform, and when placed in operation it should be cleaned daily and such disposal made of the screenings as not to create a nuisance or menace to health.

(b) That the storm water sewer be cleaned at the point now clogged near the present screen chamber, and that the connection between the screen chamber and the manhole on the storm water sewer be broken.

(c) That all breaks in the line of sewer be properly repaired.

(d) That at the point where the sewer now forms an open pond, such construction be undertaken as shall entirely correct this condition.

(e) That the settling tanks be thoroughly cleaned and that the sludge blow-off pipes be cleaned and kept in operating condition.

(f) That sludge drying beds be constructed of proper design, location, and capacity, from plans which shall have been approved by this Department.

(g) That plans for more complete treatment of the sewage of the institution be prepared and submitted for approval, and that the works provided by such plans be installed at as early a date as practicable.

4. In regard to the refuse disposal and general sanitation:

(a) That galvanized iron garbage barrels or cans with covers be supplied, and that after each emptying these barrels or cans be washed with hot water.

(b) That the intended removal of the piggery from its present location near the new tuberculosis hospital be effected as soon as possible.

Dannemora State Hospital:

1. That the hospital authorities cooperate with the prison authorities as far as possible in the investigation of and securing of necessary appropriations for a satisfactory joint supply of water.

2. In regard to the milk supply:

(a) That the institution authorities continue to make every effort possible to procure an appropriation for the erection of a new and modern cow barn, and to acquire sufficient additional pasturage to justify them in substantially increasing the hospital herd; and that until such time as this may be accomplished every effort be made to keep the quality of milk as safe as possible under existing conditions.

(b) That at the farm of Mr. Phillips such regulations regarding the handling of milk be enforced as are required of those who are selling milk in cities of this State.

(c) That milk be pasteurized at the hospital by approved methods.

3. That the institution be provided with galvanized iron garbage barrels or cans with covers, and that same be cleaned with hot water after each emptying.

FARMINGDALE (State Institute of Applied Agriculture)

An investigation of the sanitary conditions of the State Institute of Applied Agriculture at Farmingdale, Suffolk county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on July 8, 1920. A previous investigation of the sanitary condition of this institution was made by this Department in 1917 (see page 630, Vol. II, of the 38th Annual Report); a special investigation of the water supply of the institution was made in 1915 (see page 1029, Vol. II, of the 36th Annual Report); and a special investigation of the sewage disposal plant was made in 1916 (see page 793, Vol. II, of the 37th Annual Report). Plans for water supply, sewerage and sewage disposal were approved on July 10, 1914; December 24, 1914; and May 29, 1915.

Location: On the boundary line of the town of Oyster Bay, Nassau county, and the town of Babylon, Suffolk county.

Nature of institution: A school for instruction in agriculture.

Area of grounds: 308 acres.

Site of institution: The school is situated about 1½ miles north of the village of Farmingdale which is on the main line of the Long Island railroad, about 33 miles from the Pennsylvania Railroad Station in New York city. The central portion of the school property is flat, the main drainage being from hills in the northeastern part of the property toward the southwest. The ground surface drops sharply to the Amityville–Huntington highway.

Number of occupied buildings: 7, exclusive of barns and other farm and accessory buildings.

Capacity: Boys 188, girls 20, employees 60, total 268. Present accommodations permit about half of the students to live on the grounds.

Present population: Boys 157, girls 6; total enrollment 163; employees 55; total population 218. It is expected that the incoming class will bring the total enrollment in the fall to the present capacity of the school.

Class of inmates: Students in agriculture.

Water supply: The main source of the institution water supply is an 8-inch driven well 111 feet deep. From the well water is raised by air lift to a covered concrete reservoir which is located near the power house. From the reservoir water is pumped to an elevated steel tank located about 2,000 feet from the power house, with a capacity of approximately 50,000 gallons. The water supply for two farm houses located on the institution property is derived from wells. From the bottom of a dug well at the Ruland farm a pipe has been driven to a depth 10 feet greater, from which depth water is raised. At the Seaman farm a new well has been driven about 40 feet deep and located 12 feet from the house.

Milk supply: The milk supply of the institution is obtained from the institution herd which numbered 29 at the time of the investigation. The herd was tuberculin tested in March, 1920. Milk is used without pasteurization.

Sewerage and sewage disposal: The surface water and sanitary sewage is collected in separate systems of sewers. Sewage is conveyed to a disposal plant consisting of coarse screens, settling tanks, a chlorination plant, and a subsurface irrigation field. The sewage after passing through the screens flows into a sump from which it is pumped to the settling tanks of which there are 3 of the Imhoff type. A sludge press which was installed in the pump house has never operated satisfactorily. Privies are in use at the Ruland and Seaman farm houses.

Refuse disposal: Garbage is removed from the kitchen daily and is fed to swine. Rubbish is burned on a dump. Paper is burned under the power house boilers.

Recommendations

1. In regard to the water supply:

(a) That the practice of throwing wash water on the ground in the vicinity of the wells at the Ruland and Seaman farms be discontinued.

(b) That the old well chamber at the Ruland farm be filled with earth at least as fine as that of the surrounding ground.

2. In regard to the milk supply:

That the milk produced at the institution be pasteurized by approved methods.

3. In regard to the sewerage and sewage disposal:

(a) That the ground around the manholes of the sanitary sewers be so graded as to preclude the possibility of surface water entering these sewers.

(b) That the automatic float control switches intended to operate the sewage pumps be removed to a location sufficiently dry to permit of satisfactory operation of this apparatus.

(c) That the baffles of the settling tanks be repaired or reconstructed.

(d) That in view of the failure of the sludge press to operate, plans be prepared and submitted to this Department showing a suitable sludge drying bed, together with method to be employed for the placing of the sludge from the settling tanks thereon, and that such beds be constructed at an early date.

(e) That the chlorinating apparatus be repaired or replaced at the earliest possible date.

(f) That the clogging of the subsurface irrigation field or leakage from the distribution mains be properly remedied.

(g) That the present privies at the Ruland and Seaman farm houses be replaced by fly proof privies of the removable container type located not less than 100 feet from the wells; and that provisions be made to conduct the wash water from these houses to properly located and designed cesspools.

FIRE ISLAND (State Park)

An investigation of the sanitary condition of the Fire Island State Park at Fire Island, Suffolk county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on September 1, 1920. Previous examinations of the sanitary condition of the park were made by this Department in 1914 (see page 1032, Vol. II, of the 36th Annual Report). A special investigation of the water supply of the institution was made in 1917 (see page 340, Vol. II, of the 37th Annual Report). Plans for water supply and sewerage and sewage disposal were approved on April 23, 1912.

Location: Fire Island, town of Islip, county of Suffolk, N. Y.

Site of institution: The park is situated on Fire Island, which lies at this point about 5 miles off the south shore of Long Island. It is located some 2 miles from Fire Island inlet, and about 6 miles from Bay Shore, from which it is reached by boat. The park extends from the Great South bay on the north shore of the island to the Atlantic ocean on the south shore.

Area of grounds: 120 acres.

Number of occupied buildings: Four cottages and a swimming pavilion. The permanent population through the summer consists of 4 or 5 employees and their families. The visiting population is said to average about 300 people per day through the months of July and August.

Water supply: The main source of water supply is from a dug well 5 feet deep located near the center of the park property. Water is raised from the well by a pump installed on the first floor of the building over the well to a tank located on the second floor. From the tank water is piped to several buildings on the park property. A shallow driven well located about 200 feet from an employee's cottage is used as a source of supply by the occupants of the cottage. A shallow driven well near the main boardwalk fitted with a pitcher pump was not in operating condition at the time of the investigation.

Sewerage and sewage disposal: Plans which were approved by this department for sewerage and sewage disposal show one large cesspool at the public toilet building and two smaller ones at the bathing pavilion. The public toilet building was destroyed by fire in 1917, and subsequently a large privy has been in use. The cesspools at the bathing pavilion were functioning properly. Two additional cesspools for which no plans had been submitted to this Department have been constructed to care for the sewage from the park commissioner's cottage and the superintendent's cottage.

Refuse disposal: The garbage and rubbish, of which the greater part is left by picnic parties, is picked up by park employees and thrown into the waters of Great South bay.

Recommendations

1. In regard to water supply:

   (a) That the present well be filled in and a new well be constructed at a distance from the pumping plant of not less than 50 feet, the water to be drawn therefrom by the pumping equipment as located at present, and that this new well be adequately protected against contamination.

   (b) That fences be constructed inclosing an area not less than 100 feet square about each well, and that the public be excluded from the inclosed area.

2. In regard to the disposal of sewage:

   That all privies be abandoned, and water closets be provided where needed.

3. In regard to refuse disposal:

   That all garbage be buried, and all other combustible rubbish be burned at a suitable point and in such a manner as not to create a nuisance.

INDUSTRY (State Agricultural and Industrial School)

An investigation of the sanitary condition of the State Agricultural and Industrial School at Industry, Monroe county, was made by Mr. C. A. Howland, assistant engineer in this Department, on March 25, 1920. Previous investigations of the sanitary condition at the institution were made by this Department in 1911 (see page 988 of the 32nd Annual Report), in 1914 (see page 479, Vol. II, of the 35th Annual Report), and in 1918 (see page 525, Vol. II, of the 39th Annual Report). A special investigation of the sewage disposal plant was made in 1919 (see page 444, Vol. II, of the 40th Annual Report). Plans for water supply were approved on October 19, 1910; and plans for sewage disposal were approved on June 5, 1911.

Location: Industry, town of Rush, Monroe county, N. Y.

Site of institution: The institution is situated in the valley of the Genesee river, about 14 miles southwest of the city of Rochester. The grounds of the institution rise from an elevation of 530 feet above mean sea level at the river, to an elevation of about 620 feet at a point about one mile east of the river. The Rochester branch of the Erie railroad passes through the property, and the Industry station on that line is located near the main buildings of the institution.

Area of grounds: 1,432 acres.

Number of occupied buildings: About 50.

Capacity: 755 boys, 178 officers and employees, total 933.

Class of inmates: Male children between the ages of 12 and 16 years who shall be legally committed to such school by any court having authority to make such commitment.

Water supply: The water supply of the institution is taken from the municipal supply of the city of Rochester. An 8-inch pipe connects the 6-inch main distribution line of the institution with the Rush reservoir of the city water supply, and a connection also exists with the supply main from Hemlock lake to the city of Rochester.

Milk supply: The milk supply is obtained from 19 separate herds of cows maintained at the different colonies on the institution property. All cows have been tuberculin tested and are free from tuberculosis. The daily pro-

duction of milk at the time of the inspection was about 3,500 pounds. After as much milk as is needed for use at the colonies is distributed, the remainder is separated; butter is made from the cream and the skimmed milk is returned to the cottages. In the majority of cases the barns were found to be in a satisfactory condition of repair and to be carefully maintained.

Sewerage and sewage disposal: All of the occupied buildings of the institution are provided with toilet fixtures and the sewage is collected by several separate sewerage systems. Manholes have not been provided at every change of grade and alignment and trouble has been experienced with stoppages in some cases. Plans approved by this Department on June 6, 1911, show that the sewage of the institution is to be disposed of by means of 7 separate sewage disposal plants. Five of these plants have been constructed. All of the plants are of the same general type, each consisting of a settling tank, dosing tank, and sand filter. In 3 instances trenches are provided for the final disposal of the sludge. At the time of the inspection the sewage disposal plants were not in a satisfactory operating condition, and it appears that they have not been constructed entirely in accordance with the plans approved by this Department.

Refuse disposal: The garbage is stored in covered galvanized iron pails and is fed to hogs which are kept near many of the cottages. Combustible rubbish is burned, and noncombustible rubbish is placed on a dump.

Recommendations

1. That in view of the conditions surrounding the production of milk at the institution, the potentially infective character of milk, and the necessity of preventing the spread of infection from this source, arrangements be made effectively to pasteurize all the milk of the institution.
2. That the sewage disposal plants be reconstructed wherever necessary to conform to the plans approved by this Department.
3. That the sewage disposal plants be properly repaired wherever necessary and be operated efficiently throughout the entire year.
4. That all connections for the discharge of surface or roof water into the sanitary sewers be disconnected, and this water be discharged through properly constructed storm sewers into appropriate water courses.
5. That proper sewage disposal be provided in accordance with the plans approved by this Department or approved amendments thereof, for those buildings which are without sewage disposal.

IROQUOIS (Thomas Indian School)

An investigation of the sanitary condition of the Thomas Indian School at Iroquois, Erie county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on June 30, 1920. Previous examinations of the sanitary condition of the institution were made by this Department in 1911 (see page 996 of the 32nd Annual Report), and in 1914 (see page 850, Vol. II, of the 36th Annual Report), and in 1918 (see page 526, Vol. II, of the 39th Annual Report). A special investigation of the water supply of the institution was made in 1919. Plans showing certain details of additional water supply were approved on July 2, 1920, and July 27, 1920.

Location: Iroquois, Cattaraugus Indian Reservation, Erie county, N. Y.

Site of institution: The institution is situated in the valley of Cattaraugus creek, about 8 miles east of Lake Erie. The elevation of the ground at the site of the buildings is 650 feet above mean sea level, and about 80 feet above the level of Lake Erie. The nearest railroad station is Lawtons, which is on the Buffalo and Southwestern division of the Erie railroad, 27 miles south of Buffalo.

Area of grounds: 100 acres. An additional 165 acres is rented.

Number of occupied buildings: 11, not including barn, shop, and power house.

Capacity: 90 boys, 100 girls, 51 employees, total 241.

Present population: 95 boys, 100 girls, 49 employees, total 244.

Class of inmates: Destitute and orphan Indian children from any of the several Indian reservations in the State of New York.

Water supply: Four sources of water supply are available at the institution, of which 3 are in normal use. Water from a spring located on a steep hillside at a distance of about 1¼ miles from the institution buildings flows by gravity to the institution property. Two wells are in use, both of which are located in close proximity to the institution buildings. The newer well has but recently been placed in use, and at the time of the investigation water was pumped from this well by means of a temporary connection. A pond just east of the main buildings furnishes an auxiliary supply for fire protection. The pond is fed by surface water which is unquestionably polluted and unfit for domestic use.

Milk supply: The milk supply of the institution is obtained from the institution herd of 30 cows. The herd was tuberculin tested during the month of May, 1920. A new milk house has recently been constructed. The building is of brick, and in the basement are installed refrigeration and ice manufacturing plants. The milk room and two coolers are located on the main floor. The milk is used without pasteurization.

Sewerage and sewage disposal: The sewage of the institution is collected by a system of combined sewers and discharged without treatment into Cattaraugus creek, which stream empties into Lake Erie about 25 miles southwest of the city of Buffalo.

Garbage and refuse disposal: The garbage is removed from the kitchen after each meal to the piggery where it is fed to swine. Rubbish is placed on a dump.

Recommendations

1. In regard to water supply:

(a) That the permanent pumping equipment of the new well be installed and placed in operation at the earliest possible date.

(b) That provision be made for the deflection of the surface water from the vicinity of both the old and the new well, and that protection of the wells from trespassers be effected by fencing off the area around them as outlined in the body of this report.

(c) That in view of the fact that the present arrangement of piping near the pumps makes it possible for polluted water from the pond near the school building to be turned into the distribution system carrying the domestic water supply, and that in case of a large fire it would probably be necessary to use the same pumps which normally handle the domestic supply for pumping the polluted pond water, I would recommend that either the domestic and fire supplies be entirely separated, including the installation of a pump to be used for fire purposes only, or that an additional supply of pure water be developed and the use of the pond as an auxiliary source of supply be abandoned.

2. In regard to the milk supply:

(a) That in view of the conditions which exist in the old milk-room and the difficulty with which these conditions could be satisfactorily remedied, the new milk room be equipped and placed in use at the earliest possible date.

(b) That the milk used at the institution be pasteurized in accordance with approved methods.

3. In regard to disposal of sewage:

That the question of treating the domestic sewage in a suitable plant before it is discharged into the creek be considered by the institution authorities, and that plans for the necessary changes in the sewerage system and for a suitable disposal plant be prepared and submitted to this Department for approval.

4. In regard to garbage disposal:

That the garbage be removed from the vicinity of the kitchen promptly after each meal.

KINGS PARK (State Hospital)

An investigation of the sanitary condition of the Kings Park State Hospital at Kings Park, Suffolk county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on July 9 and August 30, 1920. Previous investigations of the sanitary condition of the institution were made by this Department in 1915 (see page 934, Vol. II, of the 36th Annual Report), in 1917 (see page 645, Vol. II, of the 38th Annual Report), and in 1919 (see page 425, Vol II, of the 40th Annual Report). Special investigations of the sewage disposal plant were made in 1916 (see page 666, Vol. II, of the 38th Annual Report), in 1918 (see page 546, Vol II, of the 39th Annual Report), and in 1919 (see page 446, Vol. II, of the 40th Annual Report). Plans for water supply were approved on August 31, 1915; August 22, 1918; and March 19, 1920; and plans for sewerage and sewage disposal were approved on December 29, 1908; July 28, 1912; and July 3, 1917.

Location: Kings Park, Suffolk county, Long Island, on the Wading River branch of the Long Island railroad, about 40 miles from New York city.

Site of institution: The institution is situated upon rolling ground on the shores of Smithtown bay, just west of the mouth of the Nissequoque river. The institution buildings are on ground well elevated above the bay, and the slope of the surface is such as to afford adequate natural drainage. The soil is sandy. The buildings are located about 1 mile from the north shore line of Long Island.

Area of grounds: 834.61 acres.

Number of occupied buildings: 63.

Capacity: Men 1,564, women 1,936; total inmates 3,500; employees 845; total capacity population, 4,345. A new cottage building now in construction will accommodate about 200.

Present population: Men 2,006, women 2,691; total inmates 4,697; employees 676; total present population, 5,373.

Class of inmates: All classes of insane except the criminal insane.

Water supply: The water supply of the institution is obtained from a battery of 10 deep wells located near the power house. The wells are driven through alternate strata of sand and clay and are said to average about 490 feet in depth. Water is raised from the wells to a sump by air lift. From the sump the water is pumped to an open reservoir at a distance of about 4,000 feet from the power house. The elevation of the reservoir is not sufficient to provide water for the buildings of group No. 1, and it is therefore necessary to employ a booster pump to supply these buildings. If the depth of water in the reservoir is increased beyond 6 feet, the rate of leakage equals the rate of pumping. Plans have been approved by this Department for a new reservoir at a greater elevation, but owing to lack of funds the construction had not been commenced at the time of the investigation.

Milk supply: A part of the milk supply is obtained from the institution herd of 52 head of cattle. The herd is tuberculin tested annually. Milking is done by inmates. In addition to the milk produced by the institution herd, 1,000 quarts of grade B pasteurized milk and 240 quarts of condensed milk are purchased daily. The milk produced at the institution is used without pasteurization.

Sewerage and sewage disposal: The sanitary sewage and storm water from the institution are for the most part collected in separate sewers. The sewage is conducted to a disposal plant consisting of coarse screens, settling tanks, a dosing tank, sprinkling filter, disinfection apparatus, final settling tanks, and sludge drying beds. A portion of the sewer between the main screen chamber and the settling tanks consists of duplicate lines of an inverted siphon. The settling tanks, the construction of one of which had not been completed at the time of the investigation, are of the Imhoff type. The distribution of settled sewage on the surface of the sprinkling filter is not satisfactory. A cesspool is provided to care for the sewage from the residence of the supervisor of the grounds.

Refuse disposal: A concrete garbage house is provided near each of the five main kitchens at the institution. Garbage is collected from these houses and transported to the piggery where it is fed to swine. Rubbish is burned in a wire cage in the woods beyond the piggery. Rags and papers are salvaged.

Recommendations

1. In regard to the water supply:

That added storage of sufficient capacity to furnish water at adequate pressure for fire protection be provided.

2. In regard to milk supply:

That all milk produced at the institution be pasteurized by approved methods.

3. In regard to sewerage and sewage disposal:

(a) That such recommendations of the report of this Department dated August 18, 1919, on a special investigation of the sewage disposal plant, as have not been carried out be complied with at the earliest possible date.

(b) That the nozzles now in use for the distribution of sewage on the sprinkling filter be replaced by nozzles throwing a broader spray, or that an additional distribution main for the sprinkling filter be installed, or that other means be found to overcome a sufficient portion of the loss of head now occurring in the existing distribution system to effect a better distribution of sewage.

(c) That the toilet at the piggery and the sewer leading therefrom be installed at the earliest possible date.

4. In regard to disposal of refuse:

(a) That care be exercised to keep all barrels used for the collection of garbage covered at all times.

(b) That the doors of the garbage house be kept closed.

(c) That the floors of the garbage house be washed daily.

(d) That as little garbage and bones as possible be stored at the piggery, and that such quantities as it may be necessary to store be covered and rendered inaccessible to flies.

MIDDLETOWN (State Homeopathic Hospital)

An investigation of the sanitary condition of the State Homeopathic Hospital at Middletown, Orange county, was made by Mr. C. A. Howland, assistant engineer in this Department, on January 30, 1920. Previous investigations of the sanitary condition of the institution were made by this Department in 1915 (see page 940, Vol. II, of the 36th Annual Report) and in 1918 (see page 527, Vol. II, of the 39th Annual Report).

Location: Middletown, Orange county.

Site of institution: The main buildings of the institution are located on elevated ground in the northwestern part of the city of Middletown. The surface of the ground slopes away from the main group of buildings in all directions, affording good drainage; and the drainage of the other parts of the institution property is apparently good.

Area of grounds: 540 acres.

Number of occupied buildings: 23.

Capacity: 616 men, 1,224 women, 475 employees, total 2,315.

Present population: 759 men, 1,334 women, 367 employees, total 2,460.

Class of inmates: Insane except criminal insane, from the counties of Orange, Rockland, Sullivan, and Ulster, and patients from any part of the State for whom homeopathic treatment is desired.

Water supply: The entire water supply of the institution is obtained from the public water supply of the city of Middletown, which is derived from two sources, namely, Highland lake and Monhegan lake. The wells which were previously used at the institution and which were found to be subject to contamination have been abandoned, in accordance with the recommendations of this Department. The city water supplies from both sources are treated by coagulation and are filtered, the water from Highland lake through pressure mechanical filters and that from Monhegan lake through gravity mechanical filters. The higher buildings are supplied from the Monhegan lake (lower pressure supply) by pumping, and the lower buildings are supplied directly from the Highland mains. The systems are separate, except for a cross connection at the power house, which is ordinarily kept closed. The water is pumped into an iron storage tank of 9,355 gallons capacity located in the tower of the main building, and into a similar tank of 6,840 gallons capacity located at a lower elevation in pavilion 1.

Milk supply: The milk supply is obtained partially by purchase and partially from the institution herd. Raw milk is purchased under a contract from local dealers of Middletown or vicinity. During 1919 an average of 1,080 quarts per day was so purchased. The institution herd, which at the time of the inspection consisted of 93 cows, was tested for tuberculosis in September, 1919, and the tubercular cattle were killed. The milking is done by hand twice a day, and inmates are employed in this work. A 300-gallon pasteurizer of the batch type is installed in the creamery room at the main building. The pasteurizer was not in use at the time of the inspection, and had not been used since May 5, 1919, because no ice was available for cooling the milk after pasteurization. When the equipment is used, both the purchased milk and the milk produced at the institution are pasteurized.

Sewerage and sewage disposal: The sanitary sewage of the main part of the institution is collected by a system of sanitary sewers and discharged into city sewers in West Main street and Monhegan avenue. The sewage from the power house, the kitchen sinks, and toilet of the kitchen building of the west group is conveyed to a pumping plant near the power house. A detritus chamber is located near the greenhouse. in the West Main street sewer. A cesspool has been constructed for the disposal of the sewage from the florist's cottage. A second cesspool has been provided at the contagious cottage for sewage from the bathtub and sink. The sewage from about 30 people at the Comfort farm is discharged into a tight metal settling tank from which it flows into a subsurface irrigation system.

Refuse disposal: Garbage is stored in galvanized iron cans from which it is collected daily and taken to the piggery where it is fed to swine. Rubbish is collected daily and placed on a dump, where the combustible rubbish is burned in an open fire. Rags and papers are salvaged and sold.

Recommendations

1. That all the milk used at the institution be properly pasteurized, and that the recommendations of the report of this Department of February 11, 1918 in regard to the methods of operating the pasteurizer, be carried out.

2. That a thorough study be made of the existing sewerage system of the institution, and that plans be prepared showing the existing sewerage system and sewage disposal works with such modifications and alterations

as may be necessary to provide a comprehensive system of sewerage and sewage disposal works for the entire institution, and that this study be made at once in order that the sewage of the east group may be satisfactorily incorporated.

3. That the garbage and rubbish cans be kept covered at all times.

MORRISVILLE (State School of Agriculture)

An investigation of the sanitary condition of the New York State School of Agriculture at Morrisville, Madison county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on June 18, 1920. Previous examinations of the sanitary condition of this institution were made by this Departcent in 1910 (see page 748, Vol. II, of the 32nd Annual Report), in 1914 (see page 1035, Vol. II, of the 36th Annual Report), and in 1918 (see page 529, Vol. II, of the 39th Annual Report). Plans for water supply were approved on October 20, 1914; and plans for sewerage and sewage disposal were approved on August 31, 1911, and January 20, 1919.

Location: Village of Morrisville, Madison county, N. Y.

Site of institution: The village of Morrisville lies in the valley of Callahan brook about 2½ miles west of the Morrisville station of the New York, Ontario and Western railroad. The institution is situated in the eastern part of the village, occupying the original county buildings of the county of Madison. The elevation of the ground at the main institution buildings is about 40 feet above the brook and about 1,320 feet above mean sea level. On each side of the valley the hills rise to an elevation of about 1,700 feet above sea level.

Area of grounds: 250 acres.

Number of occupied buildings: 5, not including the barns and accessory buildings.

Capacity: 200 students of both sexes.

Present population: 64 men, 15 women, 26 employees; total, 105. It is anticipated by the school authorities that the enrollment of the incoming class in the fall will increase the total student body to approximately 125. Of this number only a small proportion, about 10 per cent, live on the institution grounds.

Class of inmates: Students in agriculture.

Water supply: The water supply of the institution is derived largely from 3 springs located on property owned by the institution at a distance of about one-half mile from the main school buildings. Water from the spring chambers flows by gravity to a covered concrete storage reservoir, and from the reservoir to the school buildings. In addition to this source of supply, the municipal supply of the village of Morrisville is connected with the institution system in the cellars of several of the buildings. The village supply is derived from a reservoir located about one mile west of the village, which is largely fed by springs, and in addition receives surface drainage from a considerable area.

Milk supply: The institution owns a herd of 13 milch cows which had been tuberculin tested a few weeks previous to the investigation. Since very few of the students live at the school, only a small portion of the milk produced by the herd is consumed there. The milk is not pasteurized.

Sewerage and sewage disposal: Sewage from the main buildings of the institution is conducted through a coarse screen chamber to the sewage disposal plant, which consists of a settling tank, a dosing chamber, and a subsurface irrigation field. A second sewage disposal plant has been provided near the dairy barn to care for the drainage from the fixtures in the barn, the milk room, and administration building. The plant is located under a driveway and is completely buried. As shown on the plans, the plant consists of a circular concrete cesspool or settling tank and a subsurface irrigation field.

Refuse disposal: Such small amounts of garbage as result from the meals prepared at the dormitory are removed daily by a farmer residing a short distance from the school. Refuse and ashes are used to fill in low ground.

Recommendations

1. In regard to the water supply:

(a) That the institution authorities consider the matter of purchasing additional land to the north and east of the institution springs in order better to protect the supply from possible contamination due to the pollution of the surface of the ground in the vicinity.

(b) That diverting ditches be constructed as outlined in the body of this report designed to convey surface wash from the adjoining property away from the springs.

(c) That the open spring be protected with a closed concrete screen chamber.

(d) That a lock be provided for the present collecting basin and that the basin be kept locked at all times.

(e) That as far as possible the institution supply be used for all purposes with the exception of boiler feed water.

2. In regard to the sewage disposal plant:

(a) That the drainage system be uncovered at the point where sewage now appears on the surface, and that such repairs be made as shall prove necessary to remedy that condition.

(b) That the vents of the subsurface irrigation system be repaired and maintained in proper condition.

(c) That the valves now covered be unearthed and the valve boxes be replaced.

(d) That the automatic dosing siphon be maintained in operating condition at all times.

NAPANOCH (Eastern New York Reformatory)

An investigation of the sanitary condition of the Eastern New York Reformatory at Napanoch, Ulster county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on July 6, 1920. Previous examinations of the sanitary condition of this institution were made by this Department in 1911 (see page 1003 of the 32nd Annual Report), in 1914 (see page 480, Vol. II, of the 35th Annual Report), in 1918 (see page 530, Vol. II, of the 39th Annual Report), and in 1919 (see page 426, Vol. II, of the 40th Annual Report). Plans for sewerage and sewage disposal were approved on September 27, 1912, and February 28, 1913.

Location: At Napanoch, Wawarsing township, Ulster county, N. Y.

Site of institution: The reformatory is situated on a flat area east of Rondout creek nearly opposite the village of Napanoch and at the foot of the Shawangung mountains. The institution grounds are about 280 feet above sea level and slope gently toward the creek. To the east the land rises steeply to an elevation of 2,200 feet, the institution property extending up this slope to an elevation of 1,200 feet. The soil in the vicinity is sandy and apparently well drained.

Area of grounds: 312 acres, of which 57 acres are tillable.

Number of occupied buildings: 8, including barn.

Capacity: 496 male inmates, 44 employees, total 540.

Present population: 205 male inmates, 40 employees, total 245.

Class of inmates: Males between the ages of 16 and 30 convicted of a felony, who have not been previously convicted of any crime punishable by imprisonment in a state prison. The institution receives the surplus population of the State Reformatory at Elmira, in connection with which it is maintained.

Water supply: The water supply of the institution is obtained from a small reservoir formed by a concrete dam across a narrow valley located on a mountain side in the rear of the reformatory. The watershed tributary to the reservoir has an area of about three-quarters square mile, is unpopu-

lated, and is entirely covered with woods. The reservoir is fed largely by springs. To permit an uninterrupted supply at the time of cleaning the reservoir, an auxiliary intake is located a short distance above the main reservoir and a by-pass around the reservoir is installed. The intake at the main reservoir is located in close proximity to the up-stream face of the main dam. It consists of a vertical castiron pipe riser surmounted by a cylindrical strainer, which latter is about 10 feet above the bottom of the reservoir and 20 feet below the crest of the dam. Considerable trouble has been experienced in the past owing to the entrance of sand into the pipes and the lodging of leaves against the strainer.

Milk supply: The milk supply for the institution is obtained from a local dairy. It is used without pasteurization.

Sewerage and sewage disposal: The sanitary sewage of the institution is collected in a separate system of sewers and conducted to the disposal plant consisting of a gate chamber, 2 open settling tanks, a sludge bed, siphon dosing chamber, and a 4-unit sand filter. Trouble has been experienced in blowing off the sludge from the settling tanks owing to the presence in the tanks of articles of discarded clothing and various forms of refuse introduced into the sewers by the inmates. Work has been in progress for several years looking toward the installation of inside toilet fixtures in all cells of the northerly cell block, thus making it possible to do away with the bucket system. At the time of the inspection the number of inmates was such that it was possible to use only cells equipped with toilet fixtures.

Refuse disposal: The garbage is collected in galvanized iron receptacles and is transported to the piggery, where it is fed to swine. Nonedible portions of garbage, together with rubbish, are burned on a dump near the disposal plant. Infected garbage and refuse from the hospital ward are burned under the boilers at the power plant. Rags and papers are salvaged.

Recommendations

1. In regard to water supply:

   (a) That plans be prepared by the State Architect and submitted to this Department for a gate chamber or a modified intake as outlined in the body of the report.

   (b) That the accumulation of gravel near or above the submerged dam be removed in order that there may be a decrease in velocity of the entering water sufficient to cause deposition of the greater part of the sand above this submerged dam.

   (c) That care be exercised to protect the water supply from contamination by trespassers upon the watershed.

2. In regard to the sewage disposal plant:

   (a) That a properly constructed coarse screen be installed in the gate chamber as outlined in the body of this report.

   (b) That the present unsuitable material on the northerly unit of the filter bed be removed, and that sand suitable for use as a filtering medium be obtained and placed in these units.

   (c) That when the filtering material on these units is changed the underdrains be cleaned.

   (d) That in cleaning the sand beds, the scum and clogged sand be removed prior to the use of any mechanical implement for the loosening of the surface sand.

   (e) That great care be exercised to maintain level surfaces on the sand filter beds.

3. In regard to the disposal of garbage:

   That the receptacles used at the time of the investigation for the collection of garbage be replaced by galvanized iron garbage barrels with covers.

NEWARK (State School for Mental Defectives)

An investigation of the sanitary condition of the State School for Mental Defectives at Newark, Wayne county, was made by Mr. C. A. Howland, assistant engineer in this Department, on January 15, 1920. Previous investigations of the sanitary condition of this institution were made by this Department in 1911 (see page 1010 of the 32nd Annual Report), in 1915 (see page 835, Vol II, of the 36th Annual Report), and in 1917 (see page 634, Vol. II, of the 38th Annual Report). Plans for a filter plant to treat the water pumped from the Barge canal at the institution were approved on November 27, 1916; and plans for modifications in water main connections were approved on March 3, 1917. In May, 1917, plans for slight modifications in the arrangement of the piping system connected with the filters were approved. Plans for sewerage and sewage disposal were approved on April 3, 1907; July 13, 1909; March 10, 1913; and October 10, 1913. The institution was visited on July 26, 1916, by a representative of this Department to make an inspection in regard to proposed changes in the water supply.

Location: Village of Newark, Wayne county.

Site of institution: The institution is located on a hill just east of the village of Newark, at the south side of the Ganargua creek valley, which extends east and west at this point. Passing through the valley are the tracks of three steam railroad systems, an electric railroad, and the Barge canal. The ground slopes of the institution property appear to afford adequate drainage.

Area of grounds: 106 acres.

Number of occupied buildings: 15 (one cottage for inmates under construction).

Capacity: 1,050 women, 141 employees, total 1,191.

Present population: 984 women, 120 employees, total 1,104.

Class of inmates: Indigent feeble-minded women of child-bearing age who are residents of the State.

Water supply: The water supply for domestic use at the institution is obtained from a spring, and water for fire protection, boilers, laundry, and hot water service is pumped from the Barge canal and treated by coagulation with alum and by mechanical filtration. The spring water system is also connected with the water system of the village of Newark, and has been entirely disconnected from the Barge canal supply. The supply taken from the village of Newark is metered, but has not been used for about two years. The spring water supply flows by gravity to a sump from which it is pumped directly into the domestic water supply, the excess water discharging into an elevated steel tank. The Barge canal water is pumped from an intake in the canal to a reservoir of 1,000,000 gallons capacity. A considerable seepage takes place from this reservoir, but no tests have been made accurately to determine the amount. From the reservoir the water flows by gravity to a filter plant located in a separate building near the power house. The filter is provided with accessories, including a coagulation basin and a clear water basin. Cisterns are located in the basements of the various buildings, and these receive rain water from the roofs and excess water from the Barge canal supply.

Milk supply: The milk supply is purchased from two local milk dealers under contract. About 500 quarts of grade B raw milk are used daily.

Sewerage and sewage disposal: The sanitary sewage of the entire institution, with the exception of the power plant, is collected by a system of sanitary sewers and discharged into the sewerage system of the village of Newark. It appears that during the past three years the sewerage system has been practically rebuilt, and that no trouble from clogging of the sewers has occurred in the reconstructed system. Cesspools into which the sewage previously discharged have been eliminated from the system. The storm water at the main buildings is discharged into cisterns, while at 4 of the new buildings storm water is discharged into the reservoir of the hot water supply. The storm water and other waste water from the power house, including the wash water from the filter plant, the blow-off of the boilers, and the sanitary sewage from the flush closet, wash sink, and spray bath, are discharged onto low land on the institution property.

Refuse disposal: Garbage is stored at the kitchens in covered galvanized iron cans. It is collected twice a day and taken to the piggery, where it is fed to swine. Rubbish is placed on a dump, where it is used for filling a ravine.

Recommendations

1. That all parts of the filter plant of the hot water system, such as the loss of head gauge and the turbine water meter, be placed in service.
2. That the rate of application of the alum to the water before filtration be made, not only in accordance with the volume of water treated, but also in accordance with the amount of turbidity and color in the water which is treated, more alum being added for higher turbidity and color.
3. That the existing reservoir of the hot water system be made watertight, or that a new reservoir of proper design and construction be provided for storing this water.

OGDENSBURG (St. Lawrence State Hospital)

An investigation of the sanitary condition of the St. Lawrence State Hospital at Ogdensburg, St. Lawrence county, N. Y., was made by Mr. C. A. Howland, assistant engineer in this Department, on September 25, 1919. Previous examinations of the sanitary condition of this institution were made by this Department in 1915 (see page 953 of the 36th Annual Report), and in 1917 (see page 647 of the 38th Annual Report).

Location: Ogdensburg, St. Lawrence county.

Site of institution: The hospital is located about 3 miles northeast of the center of the city of Ogdensburg, on a point of land which extends into the St. Lawrence river. The general contours of the land are such that the drainage is good, and in fact the institution appears to be quite satisfactorily located.

Area of grounds: 1,219.25 acres.

Number of occupied buildings: 55.

Capacity: 850 men, 1,100 women, 442 employees, total 2,392.

Present population: 1,010 men, 1,257 women, 406 employees, total 2,673.

Class of inmates: All classes of insane except the criminal insane.

Water supply: The principal water supply of the institution is obtained from the public water supply of the city of Ogdensburg. In addition to this supply, a pumping plant is maintained on the banks of the St. Lawrence river to pump water from the river in case of fire. The fires under the boilers at the pumping plant are banked and maintained in readiness for use at any time. There is no doubt of the dangerous pollution of the St. Lawrence river at this point by sewage from Ogdensburg, the central part of which is about 3 miles up-stream from the institution, and by sewage from other sources. A separate system of mains has not been provided at the institution for fire service. The water supply for the laundry and for the boilers is treated in a water softener of the type constructed by the L. M. Booth Company of New York. If this pumping plant were operated in an emergency, the institution system would therefore be filled with polluted water.

Milk supply: The milk supply of the institution is obtained from a herd owned by the institution, consisting of 202 head of cattle. The cows are tuberculin tested yearly. Milking machines are used, but it is necessary for a man to follow the machine and complete the milking. Inmates are employed for this purpose and for the work about the cow barn. The milk is used without pasteurization.

Sewerage and sewage disposal: The sewage and storm water of the institution are collected by a system of combined sewers and are discharged into the St. Lawrence river without treatment. A sewer from the garden cottage discharges directly into the St. Lawrence river. The main outlet is located at the end of the point on which the institution stands. A sewer screen consisting of round iron rods arranged in the shape of a trough is located in the manhole near the Flower building.

Refuse disposal: The garbage of the institution is stored at the several buildings in galvanized iron cans, from which it is collected twice each day and conveyed to the piggery, where it is fed to swine. Rubbish is placed on a dump, where the combustible portion is burned. Rags and papers are salvaged.

Recommendations

1. That the use of the St. Lawrence river water by pumping from the river at the institution be discontinued, and arrangements be made to supply the institution, if necessary, with water of safe sanitary quality and adequate quantity and pressure at such times as the city water is inadequate in quantity or pressure.
2. That in view of the insanitary conditions caused in the cow barn by leakage from the horse stable above, the use of the second floor of the cow barn as a horse stable be discontinued as soon as possible and the ceiling of the cow barn be repaired.
3. That in view of the conditions surrounding the production of milk for the institution, the potentially infective character of milk, and the necessity of preventing the spread of infection from this source, arrangements be made effectively to pasteurize the milk supply of the institution.
4. That the garbage be stored in covered containers both at the kitchens and at the piggery, and that adequate drainage be provided for the piggery.

OXFORD (State Women's Relief Corps Home)

An investigation of the sanitary condition of the New York State Women's Relief Corps Home at Oxford, Chenango county, was made by Mr. C. A. Howland, assistant engineer in this Department, on March 12, 1920. Previous investigations of the sanitary condition of the institution were made by this Department in 1911 (see page 1020 of the 32nd Annual Report), in 1914 (see page 482, Vol. II, of the 35th Annual Report), and in 1917 (see page 636, Vol. II, of the 38th Annual Report). A special investigation of the water supply was made in 1910 (see page 572 of the 31st Annual Report). Plans for auxiliary water supply were approved on August 31, 1915, and plans for sewage disposal were approved on April 4, 1916.

Location: Town of Oxford, Chenango county, about one mile east of the center of the village of Oxford.

Site of institution: The institution property is located on the eastern slope of the Chenango river valley. The main buildings stand on a plateau about one-quarter of a mile from the river at an elevation of 75 feet above the river, while the farm buildings are located about 400 feet east of the main buildings, and the power plant and laundry are adjacent to the Delaware, Lackawanna and Western railroad tracks in the valley. The ground slopes are apparently sufficient to provide adequate drainage for the institution property.

Area of grounds: 177.5 acres.

Number of occupied buildings: 20.

Capacity: 220 inmates, 63 employees, total 283.

Present population: 22 men, 134 women, 59 employees: total 215.

Class of inmates: Aged dependent veterans and their wives, veterans' mothers and widows, and army nurses, if residents of the State of New York.

Water supply: The greater part of the water supply is obtained from 16 springs located on a hill east of the institution buildings. The water from these springs flows into the upper of two reservoirs, which in turn overflows into the lower reservoir. Only 5 or 6 of the springs yield water throughout the year. Water from an elevated tank of the Delaware, Lackawanna and Western railroad is used in the boilers and laundry and is pumped into the lower reservoir. A well for which plans were approved by this Department on August 31, 1915, has been driven between the upper and lower reservoirs. An intake pipe has been laid from the Chenango river to a concrete and brick suction chamber near the power house from which water may be pumped in case of fire. Water is supplied to the house of the head farmer and to the cow barn from two separate springs.

Milk supply: The milk supply is derived from the institution herd of 16 cows, all of which have been tuberculin tested, and all of which are tubercular. The milking is done by employees of the institution. The milk is pasteurized in a bulk pasteurizer made by the Creamery Package Manufacturing Company.

Sewerage and sewage disposal: The sewage treatment plant, consisting of a screen, Imhoff tank, sludge bed, and chlorination building, has been completed and placed in operation, with the exception that the chlorinating apparatus has not been installed. The effluent of the plant is discharged into the river through an outlet about 30 feet from the southerly bank at a point below the intake of the auxiliary water supply.

Refuse disposal: Garbage is stored in galvanized iron cans and is collected twice daily and taken to the piggery where it is fed to swine. The rubbish is disposed of on a dump located in the rear of the barn, and at the time of the inspection garbage was observed on this rubbish pile and also the entrails of slaughtered animals. Combustible refuse is burned on the dump.

Recommendations

1. That analyses be made of the water from the drilled well between the upper and lower reservoirs after a continuous period of pumping sufficient to eliminate the pollution due to not using the well, and if it be found that the water is of safe sanitary quality, the auxiliary water supply from the Delaware, Lackawanna and Western railroad water tank be abandoned, and water from the well be used to supplement the spring supply.
2. That the springs be properly protected against contamination by surface water and be surrounded by fences enclosing them and the land draining toward them.
3. That the auxiliary water supply obtained directly from the Chenango river be abandoned.
4. That the pasteurizer be thoroughly cleaned each time after use, and that it be sterilized with steam both before and after use.
5. That as soon as practicable a properly designed and constructed milk house be provided.
6. That the accumulation of scum in the settling compartment of the Imhoff tank be prevented, the sides and bottom of the settling compartment be scraped downward toward the slot to remove material adhering to them, the accumulation of scum in the gas vent be prevented by breaking it up and allowing it to settle or removing it to the sludge bed. and that only the thoroughly digested sludge be removed from the sludge compartment of the settling tank to the sludge bed during the summer at intervals of not less than one month for the present daily sewage flow at the institution.
7. That the screens be raked at sufficiently frequent intervals to prevent clogging of the screens and the screenings be disposed of by proper burial at a point where a water supply will not be contaminated.
8. That a chlorination apparatus for the treatment of the effluent from the Imhoff tank be installed as soon as the necessary appropriation can be secured, and that the chlorine be applied to the sewage at a rate of not less than 10 parts by weight of liquid chlorine to one million parts of sewage treated.
9. That no garbage or other putrescible organic matter be deposited on the rubbish dump, which should be located as far as practicable from

the institution buildings, and that such putrescible organic matter be disposed of by proper burial or other sanitary means.

10. That adequate drainage and ventilation be provided for the piggery.

POUGHKEEPSIE (Hudson River State Hospital)

An investigation of the sanitary condition of the Hudson River State Hospital at Poughkeepsie was made by Mr. C. A. Howland, assistant engineer in this Department, on April 7 and 8, 1920. Previous investigations of the sanitary condition of the institution were made by the Department in 1914 (see page 957, Vol. II, of the 36th Annual Report) and in 1918 (see page 531, Vol. II, of the 39th Annual Report). Special investigations of the water supply of the institution were made in 1914 (see page 267, Vol. II, of the 35th Annual Report) and in 1916 (see page 562, Vol. II, of the 37th Annual Report). Plans for improvements and additions to the water supply were approved by this Department on June 19, 1912; November 22, 1912; April 30, 1914; January 17, 1918; April 29, 1919; and March 20, 1920.

Location: Poughkeepsie, Dutchess county, N. Y.

Site of institution: The property of the institution is situated on the east bank of the Hudson river about 3 miles north of the city of Poughkeepsie. The topography is rather irregular. The elevation of the ground surface varies from 0 at the river to 468 feet about 1¾ miles east of the river. Back of this point the land falls away again to Fallkill creek. The soil is in general a mixed sand and clay.

Area of grounds: 893.58 acres.

Number of occupied buildings: 5 main buildings or groups and 8 cottages occupied by patients, 5 buildings occupied by officers, 7 farm houses, a power house, pumping station, and the usual farm and accessory buildings.

Capacity: 1,275 men, 1,587 women, 680 officers and employees, total 3,530.

Present population: 1,586 men, 1,956 women, 565 officers and employees, total 4,107.

Class of inmates: All classes of insane except the criminal insane.

Water supply: The main water supply of the institution is obtained from the Hudson river, and is treated by coagulation with alum, filtration through slow sand filters, and chlorination before being distributed to the buildings. The construction of a new intake, for which plans have been approved by this Department, has been begun. The water obtained through the old intake pipe is treated with alum by means of a dry feed apparatus, after which it is pumped into a coagulation basin from which it flows by gravity to two covered slow sand filters. An additional filter unit which had been constructed had caved in and will have to be rebuilt. A Wallace & Tiernan siphon feed chlorinator has been installed to chlorinate the effluent of the filters. The engineer was informed that the usual rate of chlorine application was about 0.9 parts per million, the rate having been increased after the occurrence of a number of cases of gastroenteritis at the institution. After chlorination the water flows into a subterranean concrete clear water well from which it is pumped to the storage reservoir just above the central group. A number of buildings which are too high to be supplied from the main reservoir are furnished with water by pumping directly into the mains of these buildings. There are 3 institution farms, 2 of which are supplied with well water and the third with water from a cistern.

Milk supply: The milk supply of the institution is obtained partly from the institution herd of 54 cows and partly by purchase from local dairies. About 500 quarts per day were being produced at the institution at the time of the inspection, and about 1,800 quarts per day were being purchased. The largest part of the purchased milk is delivered at the main kitchen, but about 280 quarts are delivered each day directly by the farmers to 8 cottages. No provision is made for pasteurizing either the milk produced at the hospital or the purchased milk.

Sewerage and sewage disposal: The domestic sewage of the institution is collected by a system of sanitary sewers and discharged directly into the Hudson river without treatment. The point of discharge is between the intakes of the water supply of the city of Poughkeepsie and of the Hudson River State Hospital, and so close to them that it has been possible to trace solid matter from the sewer outlets by the eye to both intakes. The grades of the sewers are in general satisfactory, and manholes are provided at frequent intervals for inspecting and cleaning the sewers. Screens are provided in the laterals from the different buildings to intercept any rags or other material which the patients may introduce into the sewers through the fixtures. The sewage from 3 cottages flows into a receiving well from which it is pumped into the gravity sewer system. At the farm houses and dairy barn and at some of the more remote buildings, privies are used.

Refuse disposal: The garbage is stored in wooden barrels or galvanized iron cans from which it is collected daily. Part of the garbage is fed to swine kept by the institution and the remainder sold to farmers. Waste paper and rags are salvaged, and rubbish is placed on a dump on the institution grounds.

Recommendations

1. That liquid chlorine be applied to the filter effluent at all times in such quantities as to produce a safe water for domestic consumption, and that the rate of application necessary effectively to sterilize the effluent from the filters be determined by careful observation.
2. That in order to provide for the continuous chlorination of the water supply a duplicate chlorinating apparatus be installed.
3. That satisfactory water supplies be provided at the Travers, Moore, and Winslow farms, either by the extension of the mains of the present general system or by the development of other supplies from satisfactory sources.
4. That the dairy barn be remodeled and put in a satisfactory sanitary condition, or if necessary a new barn be constructed.
5. That in view of the conditions surrounding the production of milk for the institution, the potentially infective character of milk, and the necessity for preventing the spread of infection from this source, arrangements be made effectively to pasteurize all milk used at the institution.
6. That a suitable sewage disposal plant for the treatment of the domestic sewage of the institution before it is discharged into the Hudson river be provided as soon as practicable.
7. That before a sewage disposal plant is constructed, all connections for the discharge of roof or other storm water into the sanitary sewers be disconnected, and the storm water be discharged into properly designed and constructed storm sewers.
8. That wherever possible the present privies be abandoned, and that those privies which it may be found necessary to retain be properly screened and be kept in a sanitary condition.

RAYBROOK (State Hospital for the Treatment of Incipient Pulmonary Tuberculosis)

An investigation of the sanitary condition of the State Hospital for the Treatment of Incipient Pulmonary Tuberculosis at Raybrook, Essex county, N. Y., was made by Mr. W. C. Emigh, assistant engineer in this Department, on June 3, 1920. Previous examinations of the sanitary condition of this institution were made by this Department in 1915 (see page 867 of the 36th Annual Report) and in 1917 (see page 637, Vol. II, of the 38th Annual Report). A special investigation of the water supply was made in 1917 (see page 493, Vol. II, of the 38th Annual Report); and special investigations of the sewage disposal plant were made in 1910 (see page 506 of the 31st Annual Report) and in 1916 (see page 830, Vol. II, of the 37th Annual

Report). Plans for sewerage and sewage disposal were approved on October 20, 1903; June 25, 1906; and July 6, 1911.

Location: Raybrook, Essex county, N. Y.

Site of institution: The institution is situated in the Adirondack mountains on the Plattsburgh and Lake Placid branch of the Delaware and Hudson railroad. It is distant about 4 miles from Saranac Lake and 6 miles from Lake Placid. The hospital is located upon ground having an elevation of something over 1,600 feet above sea level. The natural drainage is good.

Area of grounds: 516 acres.

Number of occupied buildings: 4 buildings, supplemented by a number of cottages of wood frame covered with canvas for summer use.

Capacity: 150 men, 150 women, 120 employees, total 420.

Present population: 151 men, 120 women, 110 employees, total 396.

Class of inmates: Incipient cases of pulmonary tuberculosis.

Water supply: The water supply of the institution is derived from a mountain stream. The intake is located about 2 miles from the hospital. Two reservoirs are located on a hill in the immediate rear of the hospital and have capacities of 1,000,000 and 25,000 gallons respectively. The institution does not own or control the watershed tributary to its water supply.

Milk supply: The milk supply of the hospital is obtained by purchase from a local dairy. It is used without pasteurization.

Sewerage and sewage disposal: The sanitary sewage of the institution is collected in a separate system of sewers in which it is conducted to the disposal plant, consisting of a grease trap, a settling tank, a sludge drying bed, a dosing chamber, a gate chamber, and a filter, 8 units of which are of sand and 2 of cinders. The small stream receiving the effluent has been cleaned and deepened to induce a more rapid flow.

Refuse disposal: Garbage is collected in galvanized iron barrels, and is removed under contract by a farmer who uses it for feeding to swine. All refuse of a nature not permitting such disposal is burned in an incinerator.

Recommendations

1. In regard to the water supply:

   (a) That the fence around the intake be rebuilt as outlined in greater detail in the body of this report, and that the screen at the point of intake be cleaned and repaired.

   (b) That suitable apparatus be installed by the institution at once, and that the water supply be sterilized with liquid chlorine at all times.

2. In regard to the milk supply:

   (a) That the farmer supplying milk to the hospital be urged to make such changes as he outlined to our engineer, including a new milk room, at the earliest possible date.

   (b) That milk be pasteurized at the hospital in accordance with approved methods.

3. In regard to the sewage disposal plant:

   (a) That the manhole located on the sludge pipe line be built to a greater height in order that the pressure head necessary in the outlet pipe to carry the sludge away as fast as it enters may be maintained without danger of overflow at the manhole.

   (b) That the sludge now piled on the sides of the sludge drying bed be removed.

   (c) That as outlined in detail in the body of the report, not less than three pairs of sand filter beds be operated in rotation at any one time, thereby allowing two beds to stand idle for resting and cleaning.

   (d) That the sand filter beds be maintained in operation during the entire year, and that they be ridged during the winter.

   (e) That great care be exercised to obtain an even and level surface on the filter beds after cleaning.

4. That the care at present practiced in the handling of garbage and refuse be continued, and that the party contracting for the removal of garbage be compelled to remove same twice daily during the summer months as required by his contract.

ROCHESTER (State Hospital)

An investigation of the sanitary condition of the Rochester State Hospital at Rochester, Monroe county, was made by Mr. C. A. Howland, assistant engineer in this Department, on March 22 and 23, 1920. Previous investigations of the sanitary condition of the institution were made by this Department in 1915 (see page 973, Vol. II, of the 36th Annual Report) and in 1918 (see page 532, Vol. II, of the 39th Annual Report). Plans for water supply and sewage disposal were approved on January 13, 1909, and July 27, 1915.

Location: Rochester, Monroe county, N. Y.

Site of institution: The institution property is situated in the southern part of the city of Rochester. The elevation of the ground at the main building is about 560 feet above mean sea level, and about 60 feet above the level of the Genesee river which lies 1 mile to the west of the main building. A farm maintained in connection with the institution is located on the shore of Lake Ontario about 4 miles north of the village of Webster, Monroe county, and about 16 miles from the main hospital building.

Area of grounds: 207 acres in Rochester, and 62 acres at the Lake farm.

Number of occupied buildings: 20.

Capacity: 508 men, 752 women, 340 officers and employees, total 1,600.

Present population: 631 men, 939 women, 310 officers and employees, total 1,880.

Class of inmates: All classes of insane except the criminal insane.

Water supply: The main supply of the institution is obtained, as at the time of previous inspections, from two sources, namely, from the Hemlock Lake supply of the city of Rochester and from a drilled well located on the hospital grounds. The two supplies are cross connected, the city water being used to supplement the well supply particularly in the hot water services. Water is raised from the well by means of an air jet and is then pumped into a standpipe. About 200,000 gallons per day is pumped from the well and about 60,000 gallons per day is used from the city supply. The Garden cottage has been supplied with water from the well supply but has an auxiliary dug well. The water supply of the Lake farm is derived from a spring, the water of which is pumped into a steel pressure tank.

Milk supply: The milk supply for the hospital is obtained principally from local dairymen under a six months' contract. The grade of milk is not specified and pasteurization is not required. The milk used at the Lake farm is obtained from a small herd kept on the farm, which is said to have been tested and to be free from reactors.

Sewerage and sewage disposal: The sewage from the main hospital buildings is collected by a system of sewers which discharge into the east side trunk sewer of the city of Rochester. The sewage from several buildings which are too low to drain by gravity into the main sewer, flows to the pumping station from which it is pumped into the eastside trunk sewer. The sewage from Garden cottage is disposed of by means of a circular settling tank from which the sewage overflows into a system of subsurface tile radiating from the tank.

Refuse disposal: During the winter garbage is stored in wooden barrels without covers, and during the summer it is placed in galvanized iron garbage wagons in which it is taken each morning to the piggery where it is fed to swine . Noncombustible rubbish is taken to a city dump, and combustible rubbish is burned at the farm. Salable rags and papers are salvaged.

Recommendations

1. In view of the sources from which the milk for the institution is obtained, the potentially infective character of milk, and the necessity of preventing the spread of infection from this source, I would recommend that all milk supplies for the institution be effectively pasteurized.

2. That such alterations or repairs be made to the low level sewer system as may be necessary to prevent entrance of storm water or excessive infiltration of ground water into these sewers, and that if it is found after detailed investigation that such repairs or alterations will not reduce the maximum flow of sewage below the capacity of the pumps and force main, larger pumps and a larger force main be installed at the institution.

3. That the screens at the pumping plant be arranged so that they may be more easily cleaned, and that they be cleaned at sufficiently frequent intervals to prevent them from becoming clogged.

4. That the institution authorities consider the matter of providing a more satisfactory system of sewage disposal for the Lake farm.

5. That after appropriations have been obtained for any proposed alterations in existing water supplies, sewerage or sewage disposal systems, or for proposed new water supply, sewerage or sewage disposal construction, the State Architect be requested to prepare plans for such alterations or new work and submit such plans to this Department for approval as required by the Public Health Law.

SONYEA (Craig Colony for Epileptics)

An investigation of the sanitary condition of the Craig Colony for Epileptics at Sonyea, Livingston county, N. Y., was made by Mr. W. O. Emigh, assistant engineer in this Department, on June 24 and 25, 1920. Previous examinations of the sanitary condition of this institution were made by this Department in 1911 (see page 1050 of the 32nd Annual Report), in 1914 (see page 877, Vol. II, of the 36th Annual Report), and in 1918 (see page 533, Vol. II, of the 39th Annual Report). Special investigations of the water supply of the institution were made in 1910 (see page 584 of the 31st Annual Report), in 1915 (see page 638, Vol. II, of the 36th Annual Report), in 1916 (see page 599, Vol. II, of the 37th Annual Report), and in 1918 (see page 395, Vol. II, of the 39th Annual Report); and special investigations of the sewage disposal plant were made in 1907 (see page 820, Vol. II, of the 28th Annual Report) and in 1909 (see page 210, Vol. II, of the 30th Annual Report). Plans for water supply were approved on January 25, 1913; August 3, 1916; May 29, 1917; July 5, 1917; July 16 and July 27, 1920; and plans for sewerage and sewage disposal were approved on January 20, 1904; August 16, 1920; and July 16, 1914.

Location: Sonyea, Groveland township, Livingston county.

Site of institution: The institution is situated in the valley of the Canaseraga creek, about 4 miles southeast of the village of Mount Morris. Keshequa creek which is a tributary of Canaseraga creek, flows through the institution grounds, dividing them into an eastern and western portion. The elevation of the ground varies from about 580 feet above mean sea level in the northern part to 820 feet in the southern part.

Area of grounds: 1,895 acres.

Number of occupied buildings: 99.

Capacity: Inmates, men 825, women 675, total 1,500; employees 269; total population, 1,769.

Present population: Inmates, 698 men, 798 women, total 1,406; employees 249; total population, 1,655.

Class of inmates: Epileptics of all ages, excepting infants in arms, who are indigent and residents of New York state.

Water supply: The water supply of the institution is derived entirely from Keshequa creek, except at times of high turbidity in the water of that stream. There are two separate systems of piping throughout the entire colony. One system is used for creek water which has been treated with liquid chlorine but has not been filtered, whereas the other is used for chlorinated, softened, and filtered water. Nearly all of the household water taps are connected with the filtered water system and it is expected that all will soon be so connected. The power house, pumping plant, softening plant, and filtration plants are centrally located on the west bank of Keshequa creek. A concrete dam with a double crest diverts water to the suction well from which it is pumped into the institution mains, the surplus accumulating in the outer compartment of a double standpipe located at a distance of about three-fourths of a mile from the power house. All water pumped from the creek into the raw water mains is chlorinated. About 12 per cent of the total water consumed is treated in a softening and filtration plant located on the west bank of the creek just across a highway from the power and pumping station. The softening plant is of the type manufactured by the Booth Water Softening Company, and has a rated capacity of 500,000 gallons per day. Water treated in this plant flows to a coagulation basin from which it flows by gravity to the filters. These filters are of the gravity mechanical type and were designed for a consumption of 500,000 gallons per day. The filtered water flows to a circular clear water basin from which it is pumped by pumps located in the power house to the inner compartment of the standpipe. An additional supply is occasionally derived from a well or spring located on flat land about 800 feet from the sewage disposal plant. This source of supply is subject to pollution, and as no provision has been made for chlorinating the water therefrom its use is attended with danger. Plans have recently been approved by this Department for the development as a reservoir of a natural depression situated on the institution property.

Milk supply: All the milk used at the institution is obtained from the institution herd of 65 Jersey milch cows. The herd was tuberculin tested in the fall of 1919. Milking is done by inmates and the milk is used without pasteurization.

Sewerage and sewage disposal: The sanitary sewage and storm water of the institution are collected by separate systems of sewers. The sanitary sewage is conducted to a sewage disposal plant consisting of a screen chamber, a detritus tank, a settling tank, a dosing tank, and a 12-unit sand filter. Two units of the sand filter are used for sludge drying. The 6 easterly units of the sand filter are constructed of ungraded gravel, sand, and a considerable portion of loam. The 6 westerly units are constructed of sand overlying graded gravel.

Refuse disposal: The garbage is stored at the various kitchens in galvanized iron barrels and cans from which it is collected daily and transported to the piggery where it is fed to swine. Rubbish is placed on a dump, and waste paper is baled and sold.

Recommendations

1. As regards the water supply:

(a) That the construction of the raw water storage reservoir and pipe line as shown on plans recently approved by this Department be completed and that the reservoir be placed in use at the earliest possible date.

(b) That after the completion of the storage reservoir no water be pumped directly from the creek into the distribution mains except in case of absolute necessity.

(c) That after the completion of this storage reservoir the spring supply be entirely abandoned.

(d) That no water be pumped into either distribution system which has not been filtered except in case of extreme fire emergency.

(e) That if it becomes necessary to pump raw water into either system in case of fire, such water be treated with at least .5 parts per million of chlorine.

(f) That the entire capacity of the standpipe be used as storage for filtered water.

(g) That the automatic control and loss of head gauges be placed in proper operating condition.

(h) That the sludge drying bed accessory to the coagulation basin be increased in size sufficient properly to care for the sludge resulting from the softening of the entire quantity of water used.

2. In regard to the milk supply:

(a) That the practice of employing inmates for the work of milking and handling of milk be discontinued, and that competent employees be used or milking machines be adopted for milking.

(b) That the milk used at the institution be pasteurized by approved methods.

3. In regard to sewerage and sewage disposal:

(a) That means be found to reduce the quantity of ground water entering the system, or that a pipe line be installed from the detritus tank to the settling tank of capacity sufficient to care for the maximum flow of sewage and infiltered ground water.

(b) That the siphons be thoroughly cleaned and every effort be made to maintain them in such condition that their operation will be automatic and positive at all times.

(c) That water under pressure be piped to the sewage disposal plant to provide for cleaning and flushing of tanks and drains.

(d) That the repairs to the walls of the settling tanks contemplated by the institution authorities be effected at an early date.

(e) That plans be prepared and submitted to this Department showing a sludge drying bed of sufficient capacity to care for the sludge of both the settling and detritus tanks, and that upon approval of the plans the bed be constructed.

(f) That the gravel in the filter units of the easterly row be removed and replaced by proper sand overlying graded gravel.

(g) That until the construction of a sludge drying bed and the release of two units now used for that purpose for filtering, a minimum of seven beds be maintained in operation, and that after this construction nine beds be maintained in operation at all times.

4. In regard to refuse disposal:

(a) That those in authority at the various cottages be instructed to exercise care to keep the garbage barrels and cans covered at all times.

(b) That a metal body or a metal lined body be provided for the wagon used for collecting the garbage and refuse and that this body be washed daily.

THIELLS (Letchworth Village)

An investigation of the sanitary conditions of Letchworth Village at Thiells, Rockland county, was made by Mr. C. A. Howland, assistant engineer in this Department, on January 28 and 29, 1920. Previous investigations of the sanitary conditions of the institution were made by this Department in 1915 (see page 890, Vol. II, of the 36th Annual Report), and in 1917 (see page 640, Vol. II, of the 38th Annual Report). A special investigation of the supply was made in 1912 (see page 600 of the 33rd Annual Report). Plans for water supply, sewerage and sewage disposal were approved on July 27, 1910, and on September 29, 1919.

Location: Adjoining the village of Thiells, in the towns of Haverstraw and Stony Point, Rockland county.

Site of institution: The buildings of the institution are situated principally in the valley of Minisceango creek and its north branch, while the property of the institution extends into the mountainous country bordering these streams. The property rises from an elevation of about 320 feet above mean sea level at Minisceango creek, to an elevation of about 1,140 feet on the summit of the mountain south of the water supply reservoir. In general, the property appears to be well drained, and is being graded in the vicinity of the buildings as rapidly as the available labor permits.

Area of grounds: 2,100 acres.

Number of occupied buildings: 19 (11 buildings ready to be occupied in the spring of 1920; contract awarded for the construction of 10 other buildings).

Capacity: 400 boys, 210 girls, 134 employees, total 744.

Present population: 401 boys, 210 girls, 109 employees, total 720.

Class of inmates: Epileptic and feeble-minded persons.

Water supply: The principal water supply is derived from a reservoir formed by an earth dam with a concrete core wall constructed in the western end of the institution property at the junction of two tributaries of the north branch of the Minisceango creek. There is a total watershed area above the dam of 2.9 square miles, and a storage of 21 million gallons is provided. The intakes are so arranged that water may be drawn either from the bottom of the reservoir or from an intake at an elevation 12 feet below the overflow weir crest. The water consumption is between 90,000 and 100,000 gallons per day, and the pressures at the institution are from 100 to 150 pounds per square inch. In order to protect the plumbing fixtures, it has been found necessary to install pressure reducing valves in the buildings. Trouble has been experienced at the institution with extensive pitting in the hot water system. Because of the discoloration of the water and of the material which accumulated in the range boilers, the hot water pipes on the new buildings are lined with lead. Wells are used at a number of buildings, particularly at the separate farms.

Milk supply: The entire milk supply of the institution is obtained from the institution herd of 45 cows. They are tested for tuberculosis each year and the tubercular cows are removed from the herd and disposed of. The milking is done by means of machines and the cows are stripped by hand. The milk is used without pasteurization.

Sewerage and sewage disposal: The sanitary sewage of the institution is collected in a system of separate sewers ranging from 8 inches to 16 inches in diameter. It is conveyed to a sewage disposal plant located in the southeastern part of the institution property near Minisceango creek, consisting of a diverting chamber, preliminary settling tanks, secondary settling tanks of the vertical flow type, dosing chamber, sprinkling filters, final settling tanks, a sludge digestion tank, and a sludge bed. The effluent of the final settling basins is discharged without further treatment into Minisceango creek, and at the time of the inspection no apparent conditions of nuisance were created thereby.

Refuse disposal: The garbage of the institution is stored in covered galvanized iron cans in the kitchens in winter and in buildings provided outside of the kitchens in summer. It is removed to the piggery daily where it is used for feeding. Combustible rubbish is burned on a dump in a perforated metal cylinder provided for that purpose. Ashes and noncombustible rubbish are used to fill a low area near the Secor group.

Recommendations

1. That in order to safeguard the water supply against the present possibilities of contamination, a filtration plant or a chlorination plant, or both, be installed.

2. That in order to lessen the corrosion of piping systems, particularly the hot water system, consideration be given to the following alternatives:

(a) Aeration of the supply and decarbonization by application of lime, taking the water from the surface strata of the reservoir.

(b) Reducing the temperature of the water in the hot water system to 150°F. or less by suitably installed regulating devices.

(c) Substituting cement lined, porcelain lined, or glass lined hot water heaters instead of the present iron tanks, the pressure in these tanks being regulated by supplying them from auxiliary tanks in the tops of the buildings.

(d) Use of brass pipes and tanks instead of iron pipes in the hot water system.

3. That in order to improve the physical quality of the water, lessen accumulation of silt and organic matter in the bottom of the reservoir, and free the reservoirs from stagnant and probably highly carbonated water in the bottom strata of the reservoir, the reservoir be drained or flushed out through the lower gate during periods of considerable runoff from the watershed when surplus water would otherwise be wasted through or over the waste weir.

4. In regard to the sewage disposal plant:

(a) That the piping of the smaller primary settling tanks be rearranged so that they will discharge into the pipe line from the diverting chambers to the large settling tanks, and that the use of these small settling tanks be discontinued until this is done.

(b) That the riser pipe to the valve on the sludge pipe of the first primary settling tank be repaired.

(c) That when the group of buildings now ready for occupancy is placed in service, both large settling tanks of the sewage disposal plant be used.

(d) That only the smaller of the two dosing tanks be used at the present time, but that the larger dosing tank be used alone when the new group is occupied.

(e) That the sprinkling filters be filled with filter material to the collars of the nozzles, the broken underdrains repaired, and the entire filter be placed in service.

(f) That the final settling tanks be cleaned out at sufficiently frequent intervals to prevent any considerable decomposition of organic matter in the tanks.

(g) That the sludge, after proper digestion in the sludge digestion tank, be drawn off into trenches as provided by the plans approved by this Department.

(h) That a chlorination plant for the treatment of the effluent of the sewage disposal plant, in accordance with the plans approved by this Department, be installed as soon as possible.

5. That the privy at the cow barn be discontinued and that a flush closet be provided at the cow barn, the sewage from which should be discharged into a cesspool or adequate subsurface irrigation system if no sewer of the institution system is available to receive it.

6. That in view of the conditions surrounding the production of milk in the institution, the potentially infective character of milk, and the necessity of preventing the spread of disease by this means, arrangements be made effectively to pasteurize the milk used at the institution.

WEST HAVERSTRAW (State Hospital for the Care of Crippled and Deformed Children)

An investigation of the sanitary condition of the New York State Hospital for the Care of Crippled and Deformed Children at West Haverstraw, Rockland county, was made by Mr. C. A. Howland, assistant engineer in this Department, on January 27, 1920. Previous investigations of the sanitary condition of the institution were made by this Department in 1910 (see page 688 of the 31st Annual Report), in 1914 (see page 485, Vol. II, of the 35th Annual Report), and in 1917 (see page 640, Vol. II, of the 38th Annual Report). Plans for water supply were approved on December 5, 1916, and on September 16, 1919; and plans for sewers were approved on November 15, 1905.

Location: Village of West Haverstraw and town of Haverstraw, Rockland county.

Site of institution: The institution is situated about 1 mile west of the Hudson river and about 1½ miles northwest of the West Haverstraw station on the West Shore railroad. The engineer was informed that a low area which previously existed on the institution property has been filled in with rock and ashes and covered with earth, eliminating the stagnation of water in this area. The drainage of the institution proper is said to be good. Although mosquitoes are numerous at times, they are believed not to be unusually so for this region.

Area of grounds: 93.5 acres.

Number of occupied buildings: 10.

Capacity: 76 boys, 76 girls, 82 employees, total 234.

Present population: 94 boys, 79 girls, 63 employees, total 236.

Class of inmates: Indigent children who may have resided in the State of New York for a period of not less than one year, who are crippled or deformed or are suffering from disease from which they are likely to become crippled or deformed.

Water supply: The water supply for the institution is obtained from the mains of the Haverstraw Water Supply Company of Haverstraw. A water supply to be obtained at the institution from a deep well, for which plans were approved by this Department, has not been completed. At a farm house located about one mile from the main institution buildings a well is used to supply drinking water although the village water is piped into the building. This well is subject to contamination by the means used to obtain water from it and is also exposed to surface wash. Both the analyses of samples of the water of the main supply taken at the time of the investigation and analyses made in the past show that this water supply is subject to active contamination, and cannot therefore be considered as satisfactory from a sanitary standpoint.

Milk supply: The milk supply of the institution is obtained by purchase from two dairies located at Mount Ivy, in the town of Haverstraw. It is obtained by contracts which specify that the milk shall be Grade A raw. No provision is made for pasteurization either at the dairies or at the institution.

Sewerage and sewage disposal: The sanitary sewage and storm water of the institution is collected by a system of combined sewers and discharged into the Hudson river without treatment. The sewage from the farm house is discharged into a cesspool.

Refuse disposal: The garbage of the institution is stored at the kitchen in galvanized iron cans from which it is removed after each meal and fed to the chickens or placed on a manure pile. Rubbish is placed on a dump where the combustible portions are burned.

Recommendations

1. That the well water supply of the institution, for which plans were approved by this Department, be completed and placed in service as soon as possible.
2. That the well at the farm house be abandoned and a new supply of satisfactory sanitary quality be provided, or that the well be properly protected against contamination and the water be drawn from it in such a manner as to prevent the contamination of the well.
3. That the dump for the disposal of rubbish be removed to a point as far as practicable from the institution buildings, that no garbage be disposed of on this dump, no rubbish be burned near the buildings, and that the garbage cans be covered at all times.
4. That a pasteurizer for the pasteurization of all the milk used at the institution be provided.
5. That the institution authorities take steps to provide for at least a partial treatment of the sewage of the institution before it is discharged into the Hudson river, and that plans for such treatment works

be prepared by the State Architect and submitted to this Department for approval in accordance with the provisions of section 14 of the Public Health Law.

WILLARD (State Hospital)

An investigation of the sanitary condition of the Willard State Hospital at Willard, Seneca county, N. Y., was made by Mr. C. A. Howland, assistant engineer in this Department, on December 30 and 31, 1919. Previous examinations of the sanitary condition of this institution were made by this Department in 1914 (see page 486, Vol. II, of the 35th Annual Report), and in 1918 (see page 534, Vol. II, of the 39th Annual Report). A special investigation relating to the prevalence of typhoid at the institution was made in 1910 (see page 613, Vol. II, of the 31st Annual Report). Specifications for chlorinators to treat the water supply were approved in January, 1919; and plans for sewerage and sewage disposal were approved on June 13, 1912, on condition that the effluent be sterilized before its discharge into Seneca lake.

Location: The Willard State Hospital is situated partly in the town of Romulus and partly in the town of Ovid, Seneca county, on the east shore of Seneca lake, about half way between Watkins and Geneva.

Site of institution: The grounds of the institution rise from an elevation of 444 feet above mean sea level at the lake, to an elevation of about 740 feet at a distance of 1½ miles east of the lake. The ground slopes are apparently sufficient to provide adequate drainage for the institution property.

Area of grounds: 1,204 acres.

Number of occupied buildings: 80.

Capacity: 1,016 men, 1,098 women, 518 employees, total 2,632.

Present population: 1,182 men, 1,240 women, 436 employees, total 2,858.

Class of inmates: All classes of insane except the criminal insane.

Water supply: The principal water supply of the institution is pumped from Seneca lake. The water is treated with liquid chlorine by apparatus located in the pump house. The water is pumped into a storage reservoir with a capacity equivalent to from 4 to 10 days' storage. From this reservoir water flows by gravity to a low level system. Water is also pumped from the reservoir into a high level system, storage for which is provided by an elevated steel tank. In addition to the main water supply taken from Seneca lake, several springs are in use about the institution.

Milk supply: The entire milk supply for the institution is obtained from the institution herd of 139 cows. These cows have not been recently tested for tuberculosis. Inmates are employed to do the milking. The milk is used without pasteurization.

Sewerage and sewage disposal: The sanitary sewage of the main buildings is collected by a system of separate sewers and conducted to the sewage disposal plant. The disposal plant consists of a screen chamber, a settling tank, a dosing chamber, sprinkling filters, a hypochlorite dosing apparatus, a final settling tank, and sludge bed. The effluent of the plant is discharged into Seneca lake about one mile south of the waterworks intake. Sewage from the superintendent's house and several other buildings flows to the pumping station, from which it is pumped into the main sewers. Three cottages, owing to their location in remote parts of the grounds, are not connected with the general sewerage system. From one cottage the sewage flows directly into the lake, and from the other two it is settled in tanks.

Refuse disposal: The garbage from the cottages is placed in galvanized iron cans from which it is collected and transported in metal-bodied cars mounted on standard gauge railway tracks to the piggery, where it is fed to swine. Combustible rubbish is burned in an old boiler. Noncombustible rubbish is used to fill a small depression. Rags and papers are salvaged.

Recommendations

1. That the springs from which the water supplies are derived at Hillside, Maples, and Buttonwood be properly protected against pollution, or that the springs be abandoned and water supplies of safe sanitary quality and adequate quantity be provided for these places.

2. That the institution authorities consider the matter of installing a suitable filter plant to treat all the water taken from the lake.

3. That the chlorinating device at the sewage disposal plant be placed in proper operating condition, and the chloride of lime used for treating the effluent from the sprinkling filters be applied at a uniform rate of not less than 250 pounds per million gallons of sewage treated.

4. That properly designed and constructed sewage disposal plants be installed to dispose of the sewage from Hillside, Vinelands, and Buttonwood, plans for which should be prepared by the State Architect and submitted to this Department for approval before such plants are constructed as provided by section 14 of the Public Health Law.

5. That the use of privies at the institution be discontinued wherever possible, and flush closets, the sewage from which should be discharged into the sanitary sewer system of the institution or into adequate sewage disposal plants installed to dispose of the sewage from them, be installed if necessary at some convenient place.

6. That wherever it is necessary to maintain privies the contents be made inaccessible to flies, and the privies be maintained in a sanitary condition.

INVESTIGATION OF SEWAGE DISPOSAL PLANTS

The work of investigating municipal, institutional, and private sewage disposal plants has been confined almost entirely during 1920 to plants concerning which complaints have been made, or where requests for inspections have been made by municipal or institutional authorities or local boards of health, or to plants which were involved in questions of public water supply.

In the case of each investigation a complete and accurate description of the construction and operation of the plants is obtained in the field, and after a study of the results of the investigation a report is prepared containing recommendations for any improvements necessary in the construction and operation of the plant. A copy of the report is transmitted to the municipal or institutional authorities, urging them to carry out the recommendations of the report.

The reports of the investigations made by this Department in the more important cases of sewage disposal which have come before it during 1920 are given below, and a list is appended of all other cases.

ALTAMONT

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the operating condition of the sewage disposal plant at Altamont, made by Mr. Earl Devendorf, assistant engineer in this Department, on May 7, 1920, in company with Mr. W. W. Chadsey, consulting engineer for the village.

Altamont is an incorporated village in the northwestern part of Albany county on the Delaware and Hudson railroad, 18 miles west of Albany. Its population, according to the census of 1915, is 805.

The village is provided with a public water supply owned by the village and derived from a small upland creek tributary to the Bozen kill. The intake and storage reservoir are located about 2½ miles west of the village.

The sewage of the village is collected in a separate system of sewers, and flows by gravity to a sewage disposal plant located near the Bozen kill about three-quarters of a mile northeast of the village, into which the sewage effluent from the disposal plant is discharged. The Bozen kill empties into the Normans kill above the reservoir used by the city of Watervliet as a source of public water supply. The point of discharge of the disposal plant of Altamont is about 2½ miles above this reservoir, the water from which reservoir is filtered through gravity mechanical filters and chlorinated before it is delivered to the mains. The Bozen kill has a drainage area above the disposal works of about 29.7 square miles. Plans for a system of sewers for the village of Altamont were first approved by this Department on August 19, 1907. Amended plans for sewerage and sewage disposal were later submitted to this Department and approved under date of October 5, 1917.

The disposal plant consists of an Imhoff tank, dosing chamber, sprinkling filters, and final chlorination plant. The sewage disposal works were designed to serve a population of 400 people, and arranged in units so that extensions could be made as additional houses are connected to the sewers. The estimated flow used in designing the plant was 100 gallons per capita per day.

On this basis the Imhoff tank is of such size as to give an average detention period of about 2½ hours in the sedimentation compartment, and to provide a sludge storage capacity in the digestion chamber of 1.25 cubic feet per capita, or .007 cubic foot per capita per day for 6 hours' period. The Imhoff tank has a gas vent area equivalent to .03 square foot per capita, and a total liquid capacity of 4.4 cubic feet per capita. The velocity through the tank for the maximum rate of flow is .0028 foot per second.

At the time of the inspection the flow of sewage was estimated by timing the operating cycle of the siphon which has a capacity of 600 gallons. The siphon filled in 4¼ minutes and discharged in 3¾ minutes. At this rate the flow of sewage amounted to from 175,000 to 190,000 gallons per day, or over 3½ times the estimated rate of flow. This is due to the large amount of ground water finding its way into the sewer system. From the data and information obtained by our engineer at the time of the inspection, it would appear that this ground water does not find its way into the sewer system by infiltration into the sewers themselves, but enters mainly through drains located in the cellars of inhabitants of the village. The engineer was informed that a survey is shortly to be made covering the entire village with a view to removing this source of ground water flow. The sewage as it entered the plant at the time of the inspection was very dilute, and measurements made with a turbidity rod showed a turbidity of only 15, while the tank effluent had a turbidity of 10. These results show the very dilute character of the sewage being treated at the time of the inspection.

Until this large amount of ground water entering the sewer system is removed, the present plant, especially the Imhoff tank, is overtaxed and cannot satisfactorily treat the sewage. At the time of the inspection the discharge end of the sedimentation compartment was filled with solids to a point within 1⅓ feet of the top of the water surface. When a stick was used to test the other end, solid material was also found to have accumulated over the slot. The operator in charge should daily use a squeegee to force any solids which may accumulate through the slot into the digestion chamber below.

At the time of the inspection a large amount of solid material was found to have passed from the Imhoff tank to the bottom of the siphon, which when the engineer arrived was found to be in continuous operation and did not break. This was caused by the large flow being treated at the time of the inspection, which flow exceeded the capacity of the distribution system and the siphon could be made to break in operation only by removing 2 of the nozzles on the filter bed and allowing a 2-inch stream to flow from these 2 nozzles during operation. In this connection the operator informed our engineer that during December the time of filling the dosing chamber varied from 6½ to 8 minutes, during January from 7½ to 15 minutes, during February from 7 to 10 minutes, and that commencing March 5, when it rained all night, the siphon flowed continuously without breaking due to the greatly increased flow which has during the past spring been much in excess of the usual flow.

The sprinkling filter has an area of 1,650 square feet and an average depth of 4.75 feet. The sewage is applied to the filters through 12 nozzles, of which 3 are half nozzles of the Worcester type, spaced on 13 feet centers. The filter was designed to operate at a rate of 1,000,000 gallons per acre per day, or 220,000 gallons per day per foot of depth. The nozzles operate with a maximum head of 6.5 feet and a minimum head of 1.5 feet. The underdrain system of the sprinkling filter consists of 6-inch split tile which drain to a trough on one side of the concrete floor of the filter, from which the effluent flows through a 12-inch tile pipe to the chlorinating tank.

The surface of the sprinkling filters gave evidence of being heavily overdosed, there being some pooling around the nozzles. Several of the nozzles were found to be partially clogged by solid material which had passed over from the sedimentation tank. The operator should be instructed to keep the nozzles free from all obstruction, and in cleaning the nozzles to remove only the cone and to replace the same in as short a time as possible and thus prevent any overdosing of the bed. In places where pooling has already started, it would be advisable to rake over the surface of the beds with a stone fork. The pooling of the surface of the bed appears to be caused partly by the attendant removing the base as well as the cone of the nozzles for the purpose of cleaning. While it was necessary at the time of the inspection to remove 2 of the nozzles in order to allow the siphon to break properly, as pointed out above, this practice should be discontinued, as it not only caused a heavy overdosing of that portion of the sprinkling filter beds surrounding the nozzles, but it might also loosen any organic growth which might adhere to the inner surface of the distribution system by the increased velocity through the pipes, with the result that this matter would be discharged onto the surface of the beds near the nozzles and cause clogging and pooling of the filters. In order to obviate the need for removing any of the nozzles from the sprinkling filters, the village authorities should take immediate steps to prevent ground water from reaching the sewer system, as described above. In addition, it might be well to replace the present nozzles with nozzles having larger orifices and thus increase the capacity of the distribution system. These directions, if properly carried out, will it is believed put the filters in a better operating condition for doing the work for which they were designed, namely, oxidizing the tank effluent. In addition one corner of the filter bed was filled with earth which had been washed in by the surface water from the banks above. The stone in this portion of the filter bed should be removed, washed, and replaced.

Sludge is drawn from the Imhoff tank by gravity onto the sludge bed which has an area of 225 square feet, corresponding to an area of .56 square foot per person served. At the time of the inspection no sludge had been drawn from the Imhoff tanks, and our engineer was informed that no measurements had been taken to determine the amount of sludge in the tank. In this connection it should be noted that it is much better to withdraw sludge in relatively small doses and at frequent intervals during the summen than in large doses at long intervals. A concrete apron had just been constructed at the outlet end of the sludge pipe on the surface of the bed. It is doubtful, however, if this apron is of sufficient size to prevent scouring or washing of the surface of the bed. Care should be taken to observe this point, and if conditions warrant a larger apron should be provided in order that sludge may not directly enter under portions of the bed and cause any clogging.

At the time of the inspection the chlorination plant was in operation and the manometer on the chlorinating apparatus indicated that chlorine was being applied at a rate of 1.6 pounds per 24 hours. This corresponds to a rate of application of 1.0 p.p.m. This rate is inadequate, and does not meet the requirements stipulated in the permit issued by this Department for the discharge of the sewage effluent into the stream at this point. The attendant at the plant informed our engineer that only about 1½ tanks of chlorine had been changed since the plant had been started in operation. At the time of the inspection our engineer increased the rate of application of chlorine to 10 p.p.m. as required by the permit, and instructed the attendant that the rate should never be less than this amount. When the excessive ground water is removed from the sewer flow, it is very important that the chlorine be applied at all times at a rate of not less than 10 p.p.m., in order that the water supply of Watervliet, which is taken a short distance below, may be safeguarded. While passing the plant on May 15 our engineer inspected the chlorine tank and found no gas at all being applied to the filter effluent. This, the designing engineer later stated, was due to the fact that no chlorine was at hand. In this connection care should also be taken to keep an extra cylinder of chlorine on hand at all times.

At the time of the first inspection samples of the raw sewage, Imhoff tank effluent, sprinkling filter effluent, and the final chlorinated effluent were collected and sent to the Division of Laboratories and Research for analyses, the results of which are given in the appended table.

The results of these analyses indicate that the chlorination plant was being operated in such a manner as effectively to sterilize the final effluent. The results of the stability test as measured by the methyelene blue standard show the Imhoff tank effluent and the sprinkling filter effluent to have a relative stability of 94 and 96 per cent respectively.

In view of the above facts the following conclusions may be drawn:

1. That as a result of the large amount of ground water being admitted to the sewer system at the time of the inspection, the sewage being treated at the plant was of a very dilute character.

2. That due to the excessive amount of ground water entering the sewer system, the present plant is inadequate and cannot satisfactorily treat the amount of sewage flowing at the time of the inspection.

3. That at the time of the inspection there were large accumulations of solids in the sedimentation chamber, giving rise to septization in the presence of the sewage flowing through the settling compartment.

I therefore recommend:

1. That the village authorities immediately make a detailed survey of the system with a view of reducing the amount of ground water entering the sewer system, and if it is found that the amount of ground water entering the system cannot be materially reduced, an additional unit be added to the present plant in order that the sewage may receive satisfactory treatment.

2. That the operator make monthly determinations of the depth of sludge at the bottom of the tank in the digestion chamber in order that a better record may be kept of the amount of sludge in the tank and the time for removing the sludge may thus be determined.

3. That the operator daily squeegee the sides and bottom of the sedimentation chamber in order to dislodge any solid matter which may have accumulated there due to roughness or insufficient slope and push it through the slot and thus prevent septization taking place in the sedimentation compartment.

4. That in cleaning the nozzles the practice of removing the whole nozzle be discontinued, and that the cone only be removed in order to lessen the liability of pooling on the surface of the filter bed.

5. That the stone in that portion of the filter bed which is filled with earth be removed, washed, and replaced.

6. That an extra cylinder of chlorine be constantly kept on hand and chlorine be applied to the sprinkling filter effluent at all times at a rate of not less than 10 p.p.m.

7. That a record be kept of the time of changing the cylinders of chlorine and the daily loss of waste in order that the amount of chlorine applied may be known.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *August* 10, 1920

Copies of this report were sent on August 12, 1920, to the village authorities and local board of health, to the sanitary supervisor, and to Mr. W. W. Chadsey, consulting engineer.

Altamont

SOURCE	Date	Bacteria per c. c.	B. COLI				
			1	1/10	1/100	1/1,000	1/10,000
Raw sewage — Inlet to Imhoff tank	5/7/20	42,500	......	......	2+0—	2+0—	1+1—
Imhoff tank effluent	5/7/20	59,000	......	......	2+0—	2+0—	1+1—
Filter effluent	5/7/20	12,500	......	2+0—	2+0—	2+0—	......
Chlorinated final effluent	5/7/20	10	0+3—	0+3—	0+3—	......	......
Chlorinated final effluent	5/7/20	10	0+3—	0+3—	0+3—	......	......

CORTLANDT (Town) Valeria Home

HERMANN M. BIGGS, M. D., *State Commissioner of Health:*

I beg to submit the following report on an inspection of the sewage disposal plant of the Valeria Home, Westchester county, N. Y., made on September 13, 1920, by Mr. W. C. Emigh, assistant engineer in this Department.

Valeria Home is an institution of a semi-philanthropic character, designed to provide a rest and health resort for business women at a cost lower than that generally prevailing at such resorts. It comprises about 1,000 acres, in the town of Cortlandt, and is located about 4 miles southeast of Peekskill.

The water supply of the institution is derived from driven wells located in the northeastern section of the institution grounds, about 2,800 feet from the sewage disposal plant.

Plans for sewerage and sewage disposal for the home were approved by this Department on July 15, 1918. The recent inspection was made at the time of an investigation of the feasibility, from a sanitary standpoint, of erecting a swimming pool for the use of the guests of the home.

The essential feature of the sewage disposal plant are primary settling tanks, a sprinkling filter, a secondary settling tank, and a sand filter. The sewage is collected in a system of tile sewers. It is conducted to the disposal plant where it first enters a circular upward flow settling tank 9 feet in diameter and having a depth below the flow line of 9 feet 3 inches. Sewage is introduced at a point about 1 foot above the bottom of the tank with a downward velocity. It flows upward and radially and is collected in troughs on the inside periphery of the tank. The effluent from this tank passes to a second settling tank of the two-story horizontal flow Imhoff type. Each of these tanks is provided with valves and piping for blowing off the accumulated sludge. A sludge bed is provided which is covered partly by a wooden roof and partly by glass.

The effluent of the settling tanks passes to a dosing chamber fitted with a 6-inch Miller siphon. From this chamber sewage is discharged through nozzles on to the surface of the sprinkling filter. This filter is provided with a superstructure and is thus completely inclosed. The effluent of the sprinkling filter passes to a secondary settling tank of the Imhoff type. The effluent of this tank is discharged into a closing chamber in which is a 4-inch Miller siphon. From this dosing chamber the sewage is discharged onto the surface of 2 sand filters, 23½ feet square each.

At the time of the investigation it was found that the disposal plant was not operating properly and that a leakage of sewage was taking place. The first manhole on the sewer line above the settling tanks is located at a distance of about 140 feet from the first tank. The sewage flowing through this manhole at the time was estimated to be about the quantity to be expected as a contribution from 30 people, the approximate number at the institution at the time. Owing to the nature of the construction of the first settling tank it was impracticable to observe the quantity of the sewage entering it. At the point of discharge of the effluent from the first into the second tank, the quantity of sewage appeared to be only a fraction of that observed in the manhole. A heavy scum was found on the first tank. The first siphon dosing chamber was filled to about the level thought to be the point of priming of the siphon, but the siphon was not in operation. It was stated that it had not been operated during the current year.

A small amount of sewage was flowing from 1 or 2 of the 4 nozzles in the sprinkling filter, but owing to the failure of the siphon as mentioned no periodic application of sewage occurred. It appeared that the small amount of sewage reaching this filter was lost at some point of leakage, as the siphon chamber intended to collect and discharge the effluent of the secondary Imhoff tank on to the sand filter was dry.

It thus appears that a leakage of sewage takes place between the last manhole on the sewer line and the point of entrance of sewage into the second settling tank, and that a further leakage occurs in the sprinkling filter or the secondary settling tank. As the primary settling tanks at the lower end of the sewer line are located on the brow of a steep hill, search was made for a point below the plant at which sewage which had leaked from the system reached the surface, but no such point was found. It further appears that for some cause, presumably a stoppage of the blow-off trap, the first siphon was not in operating condition. Owing to the failure of the sewage to reach the sprinkling and sand filters, it was impossible to determine the operating condition of these filters. At the time of the inspection the sludge blow-off valve of the primary Imhoff tank was opened and the accumulated sludge discharged onto the sludge drying bed, but it was found to be impossible to open the sludge blow-off valve of the first settling tank with the apparatus available.

In view of the conditions found to exist at the time of the recent inspection as described in the body of this report, it appears that the sewerage system and the sewage disposal plant at Valeria Home, in the town of Cortlandt, is not functioning properly.

I would therefore recommend:

1. That the institution authorities employ a competent sanitary engineer to make a careful inspection to determine the point or points of leakage of sewage from the system, and that such leakage be remedied.
2. That means be found to open the sludge blow-off valve of the first settling tank and that the accumulated sludge therefrom be discharged onto the sludge drying bed.
3. That the contents of the first dosing chamber be removed and the automatic dosing siphon be cleaned and placed in condition to operate properly.
4. That careful attention be given to the operation of the sewage disposal plant and that the units of the plant be maintained in efficient operating condition.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *October* 27, 1920

Copies of this report were sent on October 28, 1920, to the local board of health, to the sanitary supervisor, and to the director of Valeria Home.

NEWARK

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the sewage disposal plant of the village of Newark, Wayne county, made by Mr. Earl Devendorf, assistant engineer in this Department, on November 18, 1919.

The recent inspection of the sewage disposal plant of the village was made as the result of a request received by this Department from Dr. Augustus A. Young, local health officer, asking that this Department inspect the disposal plant, report as to its operating conditions and efficiency, and make any suggestions for bettering the operating conditions. The engineer was accompanied on the inspection by Mr. Stanley Scarth, superintendent of water and sewers.

Previous investigations of the operating condition of the sewage disposal plant of the village were made by a representative of this Department in 1914 and 1916. Reports setting forth the results of these investigations were prepared and transmitted to the village authorities and printed in the annual reports of the State Department of Health for those years. These reports give a detailed description of the construction and operation of the disposal works and this data will not therefore be reviewed at this time.

The 1914 report recommended:

1. That a sterilization plant be installed to sterilize the effluent from the disposal works, inasmuch as the village of Lyons was using the stream into which the effluent was being discharged.
2. That the pumping station be so operated as to prevent the bypassing of the sprinkling filters and of the final settling tank at all times.

3. That the uneven distribution of the settling tank effluent over the sprinkling filters be corrected.

4. That a more careful operation of the final settling tank be provided to remove the sludge more effectively.

The 1916 report recommended:

1. That the village prohibit the discharge of industrial wastes into the sewer system in sufficient quantity and of a nature such as to prevent the proper operation of the sewage disposal works.
2. That the pumping station be so operated as to provide for the treatment of the sewage at all times.
3. That provisions be made for operating the pumping station or providing changes in the dosing apparatus in order to obtain a uniform distribution of sewage applied to the trickling filters.
4. That the final settling tank be kept clean in order that no sludge shall be discharged into the creek from the disposal works.

Newark is an incorporated village located about 30 miles east of Rochester, on the New York Central, West Shore, and Northern Central railroads; the New York State Barge Canal, and an electric railroad from Rochester to Syracuse. The State Custodial Asylum for Feeble-Minded Women is also located at Newark. The population is about 7,000, not including some 800 inhabitants at the asylum.

The public water supply is owned and operated by the village, and is at present obtained from wells and by pumping from Mud creek. A new supply, however, has been under construction for the past year and will shortly be completed. This supply is obtained from an impounded stream some 7 miles south of Newark. It is intended to filter and chlorinate the new supply. For a period covering the years 1912 to 1918 inclusive, the average number of gallons pumped per day is 340,000 gallons, which corresponds to a per capita consumption of 52.1 gallons per day.

The sewer system consists of about 16 miles of sewers ranging in size from 6 to 18 inches in diameter. The sewage disposal works, consisting of an Imhoff tank, sprinkling filters, and final settling tank, were designed by Mr. J. H. Fuertes, and the plans were approved by this Department on April 17, 1912; and on May 5, 1913, revised plans for a final settling tank were approved. These works were constructed and the Imhoff tank placed in operation in the fall of 1913, and the complete plant was put in operation in April, 1914.

The plant is located in the village about half way between the New York Central and the West Shore railroads, on the right bank of a small stream known as Military brook. The nearest dwelling is owned by the village and occupied by the caretaker at the disposal plant.

The recent inspection discloses that the recommendations of the former reports have been carried out with the exception of the sterilization of the final effluent and the improvement of the distribution upon the filter beds. The engineer was informed that a chemical company, formerly discharging its wastes into the village system of sewers with the result that the proper action of the Imhoff tank was prevented, is now discharging its wastes into the Barge canal, and does not therefore effect the operation of the disposal works.

It was stated that the owner of the property located opposite the cottage owned by the village and occupied by the caretaker at the disposal works, has served notice of intention to file a claim against the village for damages due to the odors arising from the operation of the works. At the time of the inspection no objectionable odors were noticeable from the Imhoff tank or sludge drying bed. There was the usual odor of fresh sewage rising from the trickling filters when they were in operation. A strong west wind, which was said to be the prevailing wind, was blowing at the time. The house in question is located northeast of the plant, and under these conditions could not therefore be seriously affected by odors from the disposal works. This house is located some 400 feet distant from the disposal works.

The Imhoff tank appeared to be operating in a satisfactory manner. There was little or no scum on the gas vents, but evidence of gas ebullition was observed rising to the surface of the gas vents. The Imhoff tank effluent appeared to be clear and did not contain any heavy particles of organic matter.

The plant attendant had not made any record of the readings to determine the depth of sludge in the digestion chamber. For this purpose a Pitcher pump and hose may be used for determining the height of sludge of the digestion chamber. A heavy walled rubber hose 1-inch in diameter is well adapted for this purpose. It probably will be advisable to weight the lower end of the hose or attach the hose to a rod to make certain that it hangs straight down and that the results are accurate. When the hose is introduced into the tank and pumping is started, the surface of the sludge can be easily determined by raising and lowering the hose and noticing when the pump stops discharging water and the discharge of sludge begins.

It is important to ascertain accurately the height of sludge in the sludge compartment of the tanks for several reasons. The quantity of sludge and its distribution throughout the digestion chamber may be determined also by means of the sludge readings and the sludge drawn at such times and as often as is necessary to keep the surface of the sludge at a sufficient distance below the slot to prevent the clogging of the slot.

The effluent from the Imhoff tank flows to a well from which it is pumped intermittently to the siphon chamber and thence onto the trickling filters. The pump is started and stopped by an automatic float block switch. The notch adjustment on the automatic block switch was so changed at the time of the inspection as to increase the time between pumping about one-half minute. The intake well is provided with an overflow weir. In making these adjustments care should be exercised so that no tank effluent is discharged through the overflow weir into the final effluent channel which passes the intake well.

The distribution on the filters was very poor. In examining the filter bed it was found that the nozzles were partly of the square and partly of the circular type. They were covered and clogged for the most part with organic growths in such a manner as seriously to effect the distribution on the beds. The filter media was covered with organic growth, and the presence of psychoda, or moth fly, was noted. The cover on the manhole of the siphon chamber was raised and the operation of the siphon observed, from which it was found that the high water level of the siphon could be raised at least 2 feet so far as the elevation of the cover of the dosing chamber was concerned. It should be pointed out, however, that in raising this chamber it would be necessary to alter the Harding vent and raise the operating siphon of the bell so as to provide a proper amount of air under the changed operating conditions.

At the time of the inspection the circular type of nozzles were giving a better distribution than the square type. A better distribution over the entire bed would undoubtedly be obtained under the existing conditions if the square type nozzles were replaced by circular nozzles.

At present the intermittent pumping of the Imhoff tank effluent into the siphon chamber seriously affects the operation of the siphon, and consequently the distribution on the trickling filters.

The discharge of the pump into the siphon chamber is more than the discharge capacity of the siphon when operating under a low head, and this consequently causes the siphon to continue to operate under a low head, giving a very uneven and heavy overdose of sewage on the filters in the vicinity of the nozzles. This trouble may be eliminated by the installation of a larger siphon with an additional main distributor pipe line.

It was observed that the attendant made a practice of removing the base as well as the cone portion of the nozzle, allowing the sewage to flow in a large volume on the surface of the bed near the distribution pipe. This practice not only causes a heavy overdosing of the filter bed in the vicinity of the nozzles, but may also cause the organic deposits on the inner surface of the distribution system to become loosened by the increased velocity and the discharge of this organic matter on the surface of the bed causing pooling. The nozzles should be cleaned daily in order to keep them clear and provide for a proper distribution of the sewage over the surface of the beds. The effluent duct from the sprinkling filters was running approximately one-half full.

The distribution system should also be flushed out at least once a month, or as often as experience shows necessary. This can be accomplished by the operation of the valves located in the pipe gallery underneath the filter bed. It will also be possible to flush out the distribution system by means of a hose and water pressure which is supplied near the filter beds.

The final settling tank which receives the trickling filter effluent appeared to be operating in a satisfactory manner. Judging from the lack of any gas bubbles in the final settling tank, there was no septic action taking place. The engineer was informed that particular care is taken to prevent large deposits of sludge in this tank by frequently drawing off the sludge.

The sludge from both the primary and secondary tanks is pumped into the distributing troughs and thence to the sludge bed, which is built above the surface of the ground and enclosed by concrete walls. Underdrains are laid under the bed and the effluent collected by a concrete trough. At the time of the inspection the sludge bed was covered with sludge to a depth of 14 inches, and this sludge was said to have been on the bed for 2 months. It was learned that the bed does not properly drain. This condition should be remedied immediately. The bed was covered at the time of the inspection so that the condition of the bed will not be examined. It should be carefully inspected by the operator in order to determine exactly the cause for the improper draining of the bed. It may be that the underdrains have settled and have become clogged or the sand in the bed may be clogged, or some other trouble may exist which prevents the sludge from draining properly and drying more quickly. Beside drawing sludge on the sludge bed, it has been the practice to pump sludge onto the low land beyond the plant. It should not be necessary to continue this practice if the sludge bed is properly repaired, as the sludge when drawn will dry quickly in fair weather so that it may be removed and additional sludge drawn.

For the matter of keeping a record of operation which will furnish available data, it will be advisable to make a record of the date of removal and the number of cubic yards of wet sludge removed from the tanks. This can be easily determined by measuring the depth of sludge on the sludge bed after its removal from the tank. Also a record of the number of cubic yards of dry sludge removed from the bed, together with the date of removal, should be recorded. This can be ascertained by determining the capacity of the wheelbarrow or wagon used to remove the sludge and by keeping account of the number of loads removed.

The final effluent is discharged into a small stream which has been intercepted by and now discharges into the Barge canal at Newark. There were black organic deposits in the bed of the stream near the point where the effluent is discharged. The stream, at the time of the inspection, had very little flow.

In view of the above the following conclusions may be drawn:

1. That our former recommendations had been carried out in part.
2. That while the sewage disposal plant was being operated in such a manner as to not cause any conditions of nuisance to exist at the time of the inspection, there were, however, several conditions affecting the efficient operation of the plant which were in need of improvement, the more important of which are as follows:
   (a) The distribution on the trickling filters;
   (b) The cleaning of nozzles which should be done daily;
   (c) The cleaning of distribution pipe lines by flushing;
   (d) The reconstruction of sludge bed to facilitate the drying of the sludge;
   (e) The keeping of records of the operation of the plant.

I would therefore recommend:

1. That the distribution of sewage on the filters be improved as recommended in the former reports; and that as a means of temporarily improving the distribution, the operating high head of the siphon be raised or another larger siphon constructed.
2. That the practice of replacing the present square type of nozzles by others of the round type as they are broken be continued.
3. That the distribution system be frequently flushed as outlined in the report.
4. That the sludge bed be reconstructed in order that the sludge may dry within reasonable time.
5. That records of operation be kept as outlined in the report.

I would further recommend that copies of this report be transmitted to Mr. Stanley Scarth, superintendent; Dr. Frederick C. Donnelly, president of the village, and Dr. A. A. Young, health officer, and to C. R. Hervey, sanitary supervisor.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *January* 30, 1920

Copies of this report were sent on January 31, 1920, to the village authorities, to the local board of health, and to the sanitary supervisor.

PLEASANTVILLE (Hebrew Sheltering Guardian Society)

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an investigation of the operation of the sewage disposal plant at the Hebrew Sheltering Guardian society at Pleasantville, N. Y., made by Mr. Earl Devendorf, assistant engineer in this Department, on December 8, 1919.

This inspection was made as a result of a complaint received from property owners residing near the institution. This complaint stated that periodically conditions of nuisance were created from odors in the vicinity of the plant itself and from the brook into which the effluent is discharged. At the time of the inspection Mr. F. I. Frishberg, business manager of the Hebrew Sheltering Guardian Society, accompanied the engineer in the examination of the operation of the disposal plant.

A previous investigation of this disposal plant was made by a representative of this Department in 1913, and a report setting forth the results of this investigation and describing the plant in detail was published in the Annual Report of that year. The disposal plant, therefore, will not be described again at this time except to state that the plant consists of a three compartment settling tank, dosing chamber, 2 sprinkling filters, final settling tanks, dosing tank, 3 intermittent sand filters, chlorination plant, and auxiliary sludge drying beds for the disposal of the sludge from the primary and final settling tanks.

The institution, which was founded in the interest of destitute Jewish children, is located on the Sawmill river, about one mile east of Pleasantville, on the Harlem division of the New York Central railroad, about 30 miles north of New York city. At the time of the inspection there were 650 children in the institution and the number of attendants was estimated at 100, giving a total population of 750 in the institution.

The water supply for potable purposes at the institution is derived from wells, and the water is pumped into a concrete reservoir from which it is supplied by gravity. Water for laundry and boiler use is derived from the public water supply of the village of Pleasantville.

The sewage at the institution is collected in a separate system of sewers and flows by gravity to the sewage disposal plant located near a small stream tributary to the Sawmill river, into which the effluent from the disposal plant is discharged. This small stream has a drainage area above the disposal works of about 2½ square miles. The Sawmill river serves as a principal source of the public water supply of the city of Yonkers after filtration and sterilization. The intake of this supply is located at a point some 13 miles below the disposal plant.

The volume of sewage is measured by means of daily readings of a Crosby counter, which gives the number of discharges of a siphon controlling the flow to the sprinkling filters. The volume of sewage is then obtained by multiplying the number of discharges by the volume of the siphon which in this case has been calculated at 2,000 gallons. From a record of the number of discharges of the siphon from December 1 to 7, 1919, the average sewage flow amounted to 78,000 gallons per 24 hours during this period. This corresponds to a daily per capita rate of sewage contribution of 104 gallons.

The sedimentation tank which is housed over is divided into one large and two small compartments and so arranged that the three compartments may be operated in series or in parallel, or separately. It is usual to operate either the large compartment or the two small compartments at one time to facilitate cleaning the tank. Under this arrangement the sedimentation tank will give a detention period varying from 3¾ to 5 hours, depending on the rate of flow of sewage.

The settled sewage is discharged over 2 sprinkling filters having a combined area of .054 acre. The sewage is applied to each filter through 10 nozzles of the Taylor type. Each filter is covered with a frame roof and is enclosed in a structure having concrete walls with openings for the purpose of ventilating the filters. The sprinkling filters are 6½ feet in depth and were being operated at the time of the inspection at a rate of 1,450,000 gallons per acre per 24 hours.

The sprinkling filter effluent is discharged through the underdrain system into 2 final or secondary settling basins, one for each filter. These sedimentation basins have a combined capacity equal to about 2¾ hours flow of sewage with the amount of sewage being treated at the time of the inspection.

The effluent from the final settling basins is discharged by means of siphons to 3 intermittent sand filter beds having a total combined area of .2 acre. In the summer the sewage is distributed by means of channel pipes spaced 5 feet on centers. In the winter, ridges 2½ feet in height and spaced 5 feet on centers are formed on the surface of the bed between which the sewage flows.

The sand filter bed effluent is conducted to the disinfecting plant where it is treated with a hypochlorite solution in a disinfecting well located under the building which houses the disinfecting plant. The sewage has a detention period in this well of about 1 hour. From the well the effluent is discharged directly into the stream.

The sedimentation tank at the time of the inspection appeared to be operating in a satisfactory manner. No objectionable odors were to be noticed in the building housing the sedimentation tank and the tank was discharging a satisfactory effluent, having no visible particles of suspended matter going over to the sprinkling filters. The compartment which was not in use was empty and had been cleaned out. The attendant stated that it was the practice to clean one of the compartments of the tank once a month.

The sprinkling filters were found to be in generally satisfactory condition except that small pools were observed on the surface of the filters. This pooling appeared to be caused by the attendant removing the base as well as the cone of the Taylor nozzles for the purpose of cleaning the nozzles. This practice should be discontinued, as it not only causes a heavy overdosing of the portions of the sprinkling filter beds surrounding the nozzles but might also loosen any organic growths which may adhere to the inner surface of the distribution system by the increased velocity through the pipes, with the result that this matter would be discharged on to the surface of the beds near the nozzle and cause clogging and pooling of the filters. The attendants should be instructed to remove only the cone of a nozzle in cleaning, and to replace the same in as short a time as possible, and thus prevent any overdosing of the beds. In places where pooling has already started, it would be advisable to rake over the surface of the beds with a stone fork.

The sand filters were being ridged at the time of the inspection. The two small units were out of service and the large unit had been put in service on the morning of the day of the inspection. The attendant stated that it was the practice to scrape the beds every two weeks and to replace the sand yearly. The amount of sand replaced usually varied from 8 to 10 inches in depth. Each winter the beds have been ridged as described above and no difficulty in operation has been experienced.

The sand filter effluent is chlorinated as described above, and at the time of the inspection the attendant stated that he was using 20 pounds of hypochlorite of lime per 24 hours, which based on an estimated available chlorine content of 33 per cent would give a rate of application of 10 parts of chlorine per million parts of sewage treated with the amount of sewage flowing at this time.

The sludge beds are enclosed in glass-covered houses of hotbed construction. The attendant stated that it was the practice to draw sludge once a month, the amount drawn varying from 10 inches to 1 foot in depth on the two beds which have a total area of 500 square feet. This would give a volume of sludge at each drawing of approximately 500 cubic feet. This sludge, the attendant stated, would dry during the summer weather within two weeks, and in the winter within one month, to such a condition that it could be removed by a spade. The sludge is removed by means of a push-car operated on tracks to trenches where it is buried. At the time of the inspection a slight odor could be detected at a point about 100 feet distant from the sludge trench. There was no odor coming from the sludge beds as they were covered and the doors to the building were closed. In view of this condition it would be advisable for the institution authorities to cover the sludge in the trenches as soon as it is deposited.

At the time of the inspection no samples of sewage or disposal plant effluent were collected for analyses to determine the operating efficiency of the plant. The operation of this plant, however, is carried on under the continuous and careful supervision of Lederle and Provost, consulting engineers of New York city, and the attendant makes daily record of the operating conditions and takes daily samples for the stability tests. Bacteriological samples are collected weekly and analyses made by the engineers. From the records on file at the plant, the final effluent is shown to be stable for the most part. During the month of July the final effluent held its color from 5 to 14 days, and during August from 4 to 10 days.

At the time of the inspection the stream was examined at the point where the final effluent from the disposal plant is discharged. and there was no evidence of pollution either by sewage growth or sludge deposits in the stream itself, or by the presence of any objectionable odors.

In view of the above it may be concluded:

1. That at the time of the inspection the plant was operating in a generally satisfactory manner and not causing any conditions of nuisance.
2. That at the time of the inspection there was no evidence of pollution in the stream below the disposal plant.
3. That in the cleaning of the nozzles of the sprinkling filters it has been the practice to remove both the bases and the cones of the nozzles.
4. That it has not been the practice to cover the sludge deposited in the sludge trenches as soon as the sludge is removed from the sludge beds.

I would therefore recommend:

1. That the institution authorities continue, as in the past, the careful operation of the plant and the employment of expert supervision in order that any changes in conditions will be met by proper changes in the operating methods.
2. That in cleaning the nozzles on the sprinkling filters the cone portion only of the nozzle should be removed, and if any pooling should occur the surface of the stone should be loosened with a stone fork.

3. The sludge when deposited in trenches should be covered immediately with soil to a depth of not less than 12 inches.

I would further recommend that copies of this report be sent to the institution authorities, to the complainant, Dr. James Wilson Cassell, and to the local health officer, and sanitary supervisor of the district.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *January* 16, 1920

Copies of this report were sent in accordance with the above recommendations on January 16, 1920, to the institution authorities, to the complainant, to the health officer, and sanitary supervisor. On January 27, 1920, a communication was received from institution authorities stating that the recommendations of the report would receive immediate attention.

RENSSELAER COUNTY TUBERCULOSIS HOSPITAL

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report on an inspection of the sewage disposal plant at the Rensselaer County Tuberculosis Hospital, at Wynantskill, made by Mr. W. C. Emigh, assistant engineer in this Department, on November 1, 1920.

This investigation was made as a result of a request from Dr. Frank L. S. Reynolds, superintendent of the hospital, for advice relative to the operation of the disposal plant. The hospital has a capacity of 202 patients and 60 employees. At the time of the investigation there were 151 patients and 51 employees. Of the patients, 85 were men, 41 women, and 25 children. The area of the institution property is about 150 acres.

The records of this Department show that plans for water supply, sewerage and sewage disposal for the Rensselaer County Tuberculosis Hospital were approved June 20, 1917. The water supply as shown on these plans was to be derived from driven wells located about 150 feet from a pond in the eastern portion of the property. At the time of the approval of the plans information was received by the Department to the effect that the soil at the location of the wells consisted of 2 feet of top soil, 30 feet of gravel, 40 feet of hardpan, 1 to 3 feet of fine sand, and 10 to 12 feet of shale rock. The ground water table was at an elevation of about 7 inches above the water surface of the pond, thus indicating that the general direction of flow was from the wells toward the pond. At the time of the investigation the water consumption was estimated by the engineer of the institution to be approximately 18,000 gallons per day.

The approved plans for sewerage and sewage disposal provided for the collection of the sewage from the hospital buildings in tile sewers from 4 to 8 inches in diameter, and for the disposal of the sewage in a sewage disposal plant consisting of a settling tank and a subsurface irrigation field. The settling tank was to be 15 feet by 40 feet in plan, with a depth below the center of the outlet pipe of 5 feet. It was divided into two equal compartments by a longitudinal partition wall. A capacity of nearly 22,000 gallons was thus provided if no allowance be made for space occupied by sludge. This is approximately equal to the estimated water consumption of the institution per 24 hours and somewhat in excess of the present consumption. The two compartments of the tank were designed to operate in parallel. A valve was provided on the pipe entering each compartment. A concrete curtain baffle was to extend across each compartment, 4 feet from the tank wall at the inlet end. A submerged outlet was provided. Access to the tank is afforded by a rectangular manhole at the inlet end and 2 circular manholes at the outlet end. A pipe line from each compartment joining a few feet outside of the tank provides a means for removing accumulated sludge to the sludge drying bed located at a distance of about 350 feet from the tank.

From the tank the settled sewage was to flow through a short line of pipe into a concrete distributing channel and thence into lines of 3-inch agricultural tile laid about 18-inches below the ground surface. There are 42 lines of tile shown, each 200 feet long, 21 lines extending in a northerly direction from the distributing channel and an equal number from opposite points of the channel in a southerly direction. The distributing channel is shown on a considerable slope, and in order to fill all lines of tile without producing a large hydrostatic head in any line, weirs are shown about 18 inches below each pair of lines of lateral distributing tile. These weirs were so designed as to raise the water level behind them about one inch above the top of the lateral tile. The tiles were to be laid with ½-inch open joints covered with three-ply tar paper on a bed of coarse sand and gravel and with a slope of 4 inches in 100 feet.

At the time of the investigation it was found that in general the sewage disposal plant had been constructed in accordance with the plans but that in some details the construction was at variance therewith. In the easterly compartment of the settling tank there was about 6 inches of scum, whereas in the westerly compartment there was practically no scum. Only a few inches of sludge was found in the tank. It was stated by the chief engineer of the institution that at the time of cleaning the tank in the spring of 1920 the conditions as regards relative quantities of scum in the two compartments were reversed, the greater quantity at that time being in the westerly compartment. It is further stated that sludge had not been removed from the tank during the summer or fall of the current year.

In the distributing channel sewage was flowing over 18 of the 20 weirs. Sewage was passing under or around the ends of the two remaining weirs, which resulted in cutting out the 4 lines of tile intended to be submerged by these two weirs.

The ground surface slopes in an easterly direction. A few feet beyond the lowest line of tile it drops off steeply. At a point near the northerly end of this line the brow of the hill approaches to within a few inches of the tile. At this point sewage was rising to the surface of the ground and flowing down the embankment to a depression from which there was no surface outlet. The point at which the sewage was rising to the surface is about 700 feet from the location of the nearest proposed well as indicated on the approved plans, and the depression in which the sewage was absorbed is about 500 feet from the same well. A ridge rising about 12 feet above the depression separates it from the well. The ground surface of the well is about 20 feet below that of the depression.

Upon removing the gravel to a depth of about 6 inches below the surface, it was found that one length of tile was about 3 inches out of line and had been broken. No tar paper was found over the joints. It is possible that the proximity of the tile at this point to the brow of the hill and to the surface of the ground resulted in displacement of the tile at the time of some movement of the gravel over a limited area. Our engineer was unable to determine the relative quantities of sewage entering the distributing channel and flowing through this break, but it appeared that at least half and perhaps a considerably larger proportion was thus escaping to the ground surface.

A section of tile was uncovered at a point near the northern extremity of another of the northerly lines of tile. No tar paper was found at the joint, and it did not appear that sewage had ever reached that point of the field. It would thus appear that there is either a stoppage in this line or that the extremity of the line is at a higher elevation than the point of entrance of sewage.

A third point was uncovered just north of the distributing channel and about one-third of the way from the westerly to the easterly side of the field. Tar paper was found at this point but the tile joint was so tight that sewage which was standing in the tile was unable to escape into the excavation until the joint had been opened slightly. It was stated by the superintendent of the hospital that in the past sewage has reached the surface at points in the field which are now dry. It thus appears that at some points the tile is not properly laid but to what extent this condition existed it was impossible at the time of the recent investigation to determine.

In view of the conditions found to exist at the Rensselaer County Tuberculosis Hospital at the time of the recent investigation, and after a careful comparison of these conditions, together with the plans for the sewage disposal plant as approved by this Department, it appears:

1. That the plant was not constructed entirely in accordance with the approved plans.
2. That the present unsatisfactory operation of the plant is in some measure due to this departure of construction from design.
3. That at one or more points of the subsurface irrigation field the tile is not provided with sufficient covering of earth.

I would therefore recommend:

1. That the institution authorities cause each line of agricultural tile to be uncovered at intervals not to exceed 25 feet in order that information may be obtained as to the condition of each line.
2. That the services of a competent engineer experienced in this type of construction be secured and that such engineer examine the condition of the tile as to openings provided at joints, the elevation and slope of the tile, and such other particulars as may bear upon the efficiency of operation and conformity to the approved plans.
3. That the tile be repaired or relaid so far as the findings of such an investigation prove necessary.
4. That at the point at which sewage was rising to the surface of the ground at the time of the investigation, the tile be properly relaid and sufficient material placed over and around the tile to provide about 18-inch cover and at least 2 feet on the lower side of the tile.

Respectfully submitted
THEODORE HORTON
Chief Engineer

ALBANY, N. Y., *November* 22, 1920

Copies of this report were sent on November 22, 1920, to the superintendent of Rensselaer County Tuberculosis Hospital and to the sanitary supervisor.

SCHENECTADY COUNTY TUBERCULOSIS HOSPITAL

HERMANN M. BIGGS, M.D., *State Commissioner of Health:*

I beg to submit the following report upon the results of a field inspection of the Schenectady County Tuberculosis Hospital, in the town of Glenville, Schenectady county, N. Y., on July 20, 1920, made upon the request of the Supervisor of the Division of Tuberculosis of this Department, to whom the hospital superintendent had complained by telephone on July 15, 1920, concerning the costly upkeep and unsatisfactory operation of the disposal plant.

This institution is about 4 miles northeast of the city of Schenectady, in the Mohawk valley, on high ground at the Indian Creek fork of Alplaus kill, from which former stream the water supply for the institution is taken. The intake of the water supply is above a dam about half a mile higher upstream than the point of entry of the effluent from the disposal works.

Original plans for a disposal plant for this hospital were approved by this Department on May 2, 1911. They contemplated the disposal of the sewage from a population of 60 persons by tank treatment followed by subsurface irrigation. Following an increase in capacity of this hospital, on October 22, 1914, plans were approved for the treatment of the sewage from an estimated future population of 100 per sons by tank treatment, followed by sprinkling filters, secondary settling tanks, and intermittent sand filters. The design was based on an estimated flow of sewage of 5,000 gallons per day.

These plans last mentioned showed that the former tanks and dosing chamber were to be made into one tank by the removal of an intervening partition. Our report on the examination of these plans pointed out that the detention period for settlement would thus be increased. The report of the designing engineer of September 28, 1914, stated that the form of tank bottom would be changed to facilitate blowing off sludge, and advised the replacement of this tank with an Imhoff tank as soon as funds permitted, and stated that the design was based on a present 12-hour detention in the primary settling or septic tank and 2 hours in the final settling tank.

The superintendent stated that the sprinkling filter required very frequent cleaning at great cost, and seemed to operate but a short time before it clogs up with black deposits which it was claimed were formerly responsible for the clogging of the former subsurface irrigation system. These black deposits are also discharged with the sprinkling filter effluent and rapidly stopped up the sand beds, requiring constant raking and frequent renewal of sand. He also stated that particles of solidified grease seemed to pass through the system and stop up the sprinkler nozzles so that it is necessary to clean them every hour or to put on homemade nozzles with larger orifices but less distributing area to which he had been obliged to resort.

He reported that the sprinkling filter had been cleaned this spring and showed our engineer a pile of small stones and dust about 3 feet high mostly capable of passing a half-inch ring, which had been screened out and replaced with 6-inch stone placed around the underdrains. In spite of this the clogging had continued, so that the top few feet of the stone beds had to be washed out by fire hose only a week or so before. He also reported that the primary settling tank when cleaned this spring had about 3 feet of solid scum on it, and that practically all the rest of it was filled with a molasses-like mass of sludge so thick that it could be bailed out with a bucket containing half-inch holes.

The plumber at the institution reported that caked or congealed grease was not only found at the sprinkler nozzles but was found in all the manholes below the administration building. He picked out a sample of congealed grease lying on the half-inch mesh screen which he had placed between the discharge from the septic tank and the dosing chamber serving the sprinkling filter. He also showed how it had quickly clogged a mosquito screen which had apparently been tried in this position.

The plumber stated that the interval between siphon discharges to the sprinkler bed was between 15 and 60 minutes during the day, but somewhat less at times when washing or such work was being done. The head nurse gave some information from which the amount of soda and soap used in the administration building was deduced, and also stated that liquid soap was used in the hospital buildings, one or two 5-pint bottles a week being distributed to the five principal buildings, so that it would seem from this that about 6 pounds of soap per day was being used at points other than the administration building in addition to the soap in the moppings from the floors of all the buildings which also pass into the sewer.

The population at present consists of between 70 and 90 patients, who with about 20 employees and attendants make a present total average population about 100. The flow of sewage according to data furnished by the superintendent of the institution ranges from 6,000 to 10,000 gallons per day, which is from 20 per cent to 100 per cent higher than that for which the disposal plant was designed. It is planned to install an additional building for 20 patients, which will bring the total population at the institution up to some 130 counting attendant employees.

Sewerage System

The sewers serving the various buildings vary in size from 4 inches to 5 inches in diameter. They appear to be laid on a comparatively flat grade to the first manhole on the line to the disposal works, after which the slopes appear to be steeper. The maximum length of the branch sewers is about 600 feet, while the length of the 6-inch outfall is slightly longer.

The first point on the sewer system observed was the grease trap at the main building. The dimensions of this trap are about 6 feet long by 6 feet wide by 3½ feet deep, giving a capacity of 950 gallons. There is also an end chamber 1½ feet long connected with the trap which has a capacity of 250 gallons. The partition between the two chambers is perforated by a downturned elbow which discharges from a point a foot or more below the surface of the effluent from the larger chamber. The grease trap had been cleaned only about a week before the time of the examination, and there was only about 2 inches of scum in the large chamber and not more than 1/16 of an inch in the small chamber.

The largest contribution to the contents of the grease trap is the discharge from the kitchen of the administration building where the cooking and dish washing for the entire hospital is done. There appears to be used daily on the average about 5 pounds of soda and 2 or 3 pounds of soap powder, and possibly 3 pounds more of homemade soap and ivory soap in the kitchen. It was found that the intake pipes to this grease trap passes for a distance of 10 or 15 feet through a very hot basement room in which is located the high pressure boiler, and that the wall of the grease trap adjoins the wall of the administration building opposite which is located this boiler room. It appears, therefore, that the piping and grease trap are so located as to inhibit to a large extent the proper operation of the trap and the effective removal of the grease from the kitchen wastes.

The sewer pipes so far as could be observed from manholes were open and in good condition, the flow through the pipe when observed at 10 A. M. being about half an inch deep in most cases. Particles of caked white grease were, however, to be found in the manholes, and it was learned that there had been occasional stoppages of sewers due to grease. The ventilated covers of the manholes had no buckets beneath them, so that in addition to the stoppage from grease and slight grades occasional tendency to stop might be produced by careless opening of the manhole and the deposition therein of the dirt adhering and surrounding their covers.

Disposal Plant

The sewage disposal plant consists of a settling tank, sprinkling filter, secondary settling tank, sand filters, and auxiliary dosing tanks. From measurements made of the plant, the settling tank was found to be 12 feet long and 4 feet deep by about 4 feet wide at the lower end and 8 feet at the upper end. The contents of the tank when clean is about 2,600 gallons, giving an average detention period of about 5 hours for a flow of 10,000 gallons per day. The minimum detention period is probably only about 2 or 3 hours at times even when the tank is clean. The adjoining dosing chamber has hydraulic dimensions of 2 feet 6 inches square by 3 feet deep, which with the allowance for the bell gives it a dosing discharge capacity of about 120 gallons.

The sprinkling filter is 36 feet long by 9 feet 6 inches wide and has an area of 342 square feet, or .0079 acre. The volume of the sprinkling filter, which is about 6 feet deep, is approximately 2,050 cubic feet, or .047 acre of filter 1 foot deep, which gives a rate of filtration of 200,000 gallons per acre per day per foot of depth, or 1,250,000 gallons per day per acre of filter when treating 10,000 gallons of sewage per day. The 4 sprinkler nozzles are located 9 feet 6 inches apart. The radius of the maximum are reached by the discharge of the nozzles about 2 feet 6 inches so that only about one-fourth of the area of the filter was in effective use due to the unsatisfactory distribution provided by the nozzles.

The secondary settling tank following the sprinkling filters is 4 feet wide by 2½ to 4½ feet long by 5 feet 6 inches in hydraulic depth. It has, therefore, a maximum content of about 600 gallons, and provides a detention period of 1 hour and 25 minutes based on the rate of flow of 10,000 gallons a day. Attached to the secondary settling tank is the dosing tank having a width of 4 feet, a length of 2 feet 6 inches, and a depth of about 2 feet 10 inches, giving it a hydraulic capacity of about 200 gallons. This tank is provided with an automatic discharge siphon which discharges the contents of the tank intermittently to the sand filters.

The sand beds were designed with a depth of 2 feet 6 inches, but the depth had been reduced by scraping off about 2 feet. The beds were slightly lower at the concrete slabs under the discharge pipes than they were at the far ends. There are 4 of these sand filters, approximately 12 feet 11 inches by 17 feet 6 inches in size, giving them an area each of about 226 square feet, or .005 acre, or a combined area for the 4 beds of .02 acre. The discharge from the dosing tank to the sand filters is sufficient to cover one bed to a depth of 1.4 inches. The rate of filtration based on a flow at the rate of 10,000 gallons a day for all 4 filters is about 500,000 gallons per acre per day. This rate of operation is excessive, and can only be maintained by the most careful supervision. If the proposed addition to the hospital is constructed and the population increased, it will be necessary to install at least one more bed of the same size as one of the existing beds.

The effluent pipe from the underdrains of the sand filters discharges through some 200 feet of pipe into Indian Brook. The effluent is nearly clear and colorless, and the plant appeared to produce satisfactory results although it requires constant attention.

Operation During Inspection

At the time of the inspection there was about 6 inches of scum on the settling tank and a considerable amount of sludge which appeared to be disturbed on account of the comparatively shallow depth and small size of the tank. When the siphon serving the sprinkling filter discharged only 1 of the 4 nozzles worked. The examination of the other 3 nozzles showed that they were stopped up with particles of white caked grease from ⅛ to ½ inch in diameter, and the removal of the nozzle and the grease was followed by the discharge of sewage containing large particles of black matter. Considerable solids were also deposited in the sand beds from the discharge of the second dosing tank. The discharge on to the 4 sand beds is not automatically controlled, but either 1, 2, 3, or 4 could be arranged to be dosed at the same time.

At the time of observation 2 of the sand filters were flooded to a depth of about 6 inches and very little subsidence was noticeable in the water. About half the area of each of the two beds in use was covered with black deposit, although the filters had been cleaned but a day or two before. Samples of this black filter deposit as well as of the white caked grease were obtained, and excavation was made in the stone beds revealing a fairly congested or solidified and earthy condition accompanied by the usual presence of earth worms at a depth of about 1½ feet at a point midway between the sprinkler nozzles.

The inspection also showed that owing to a material increase of population above the population of 60 for which the tank was originally designed, the present nature of the sewage and grease, and the nearly doubled rate of contribution, the average hydraulic content of the shallow primary settling tank available for storage has been relatively reduced so that the designed period of tank detention is not attained. It was found, further, that steam dishwashers and apparatus using soap powders had been introduced into the administration building, and that in addition to this condition the piping and grease trap serving the kitchen are so located as to heat the pipes and trap and make the trap inefficient in the removal of grease.

The inspection revealed that grease passed this trap, caked in the sewers, and clogged the sprinklers so that open nozzles with 2½-foot throw had been substituted for the 5-foot throw nozzles originally installed, greatly lessening the area of the bed actually in use, and that 3 out of 4 of these sprinklers were stopped at the time of the inspection. This concentrated and unequal distribution, in combination with the faulty tank action, permitted the escape of very numerous particles of suspended matter, had led to a rapid clogging of the stone bed and the passing of black coagulant masses of suspended matter through the final settling tank into the sand filter surface. This made constant and costly cleaning of the beds and tanks necessary.

In conclusion, I would state that it was found from the inspection that the grease trap at the institution is not so placed and arranged as to secure uniformly the congealing of greases from the kitchen, and that certain portions of the plant have been overtaxed by the large rate of flow now obtaining. The present preliminary settling tank was designed to care for a population of 60 persons and provide for a preliminary treatment in connection with a small subsurface irrigation system which was outgrown and abandoned, and the adoption of the tank for the present disposal system was rather of a temporary nature as it was expected by the designing engineer that a two-story tank would be substituted for it after the final installation of the present plant. The population tributary to the plant has nearly doubled since the tank was installed. The nozzles of the sprinkling filters were found to be of an inferior type which did not give a satisfactory distribution and the frequent clogging of the nozzles still further reduced the efficiency of the sprinkling filter. Furthermore, the sand filters have been outgrown and are now treating more sewage than they were designed to care for. Furthermore, if the institution is enlarged, this portion of the plant will be greatly overtaxed.

In view of the above I would make the following recommendations:

1. That a second grease trap similar to the present existing grease trap be placed beyond the present grease trap at a distance from the heated pipes and buildings, and that the effluent from the existing grease trap be led through this second trap, the outlet from which should be submerged one-third the wetted depth of the grease trap.
2. That the present primary settling tank which has been outgrown be abandoned, and that as originally recommended by the engineer designing the plant, a new two-story primary settling tank of adequate size properly to care for the contemplated future population of the hospital be installed.
3. That new standard circular throw sprinkler nozzles suitable for distributing the sewage over the entire area of the sprinkling filter be at once provided in duplicate, and maintained in use at times by sufficient attention regardless of any frequency of obstruction by grease or other matter.
4. That if a total population in excess of 100 be contemplated in the near future, at least one more sand filter having a size equal to that of one of the existing filters be installed.
5. That a competent sanitary engineer be employed to draw up plans for changes, additions, or modifications in the sewerage and sewage disposal systems, and that such plans be submitted in duplicate to this Department for approval as required by the Public Health Law before any changes, additions, or modifications are made in the disposal plant.

Respectfully submitted

THEODORE HORTON

Chief Engineer

ALBANY, N. Y., *September* 22, 1920

On September 22, 1920, a copy of this report was sent to the superintendent of the Schenectady County Tuberculosis Hospital.

In addition to the foregoing, inspections were made and reports transmitted to the local authorities, or advice was given through correspondence with reference to the disposal of sewage at the following places: Beekman (town), Sylvan Lake Camp for Girls; Berne (town), Camp Orinsekwa; Brockport; Hopkinton (town), Ayrmont Dairy Company; Long Beach; Rome (State Institution for Feeble-Minded Children); Seneca Falls; Stamford; Thiells (Letchworth Village).

INVESTIGATION OF MILK PASTEURIZING PLANTS

The investigation of the construction, sanitary conditions, equipment, methods of operation, and efficiency of milk pasteurizing plants was continued during 1920. The force available for this work for 1920 was reduced to one inspector, and owing to illness and special emergency work his services were available for only a part of the year. It was possible, nevertheless, to make 260 inspections and reinspections during this year. This number includes 54 milk pasteurizing plants which ship milk or cream to New York city, and also 95 plants pasteurizing milk in Buffalo which were inspected toward the end of this year but upon which no reports had been made up to the end of the year.

As in previous years, in the case of each plant inspected, except those which ship to New York city, a report setting forth results of the inspection and making recommendations for improvements in the method of operation, equipment, and construction of each plant was transmitted to the plant owner and to the local health authorities.

Of the plants inspected, 23 have permanently discontinued pasteurization of milk, 2 have temporarily discontinued pasteurization, and 1 has discontinued the sale of milk and cream in this State since 1919. Of the 23 plants which have permanently discontinued pasteurization, 12 still serve as bottling plants. At these plants the raw milk is taken by the dealers to a milk pasteurizing plant where it is pasteurized. After it has been pasteurized, the milk is transported in cans to the bottling plants, where it is strained through cheesecloth over the bottle filler. It is then bottled, and in most cases capped by hand, after which it is delivered to the consumer. This method of handling pasteurized milk is not satisfactory, and unless the operator observes special precautions as regards sanitary conditions and transportation and in method of handling, the milk is liable to contamination. The owners of the remaining 11 plants which have discontinued pasteurization have combined to form two large companies.

Of the pasteurizing plants inspected last year, 19 were not reinspected this year. According to recent information from health officers, there are also 32 plants pasteurizing milk for local consumption which have not been inspected by this Department. These plants have been placed on our list for inspection in the near future.

From the inspection work in this State it has been found that there are the following four distinct methods used in the pasteurization of milk and cream:

1. Pasteurization by the continuous method;
2. Pasteurization by the batch method;
3. Pasteurization by the "in bottle" method;
4. Pasteurization in the milk can.

The accompanying table indicates that of the 197 plants inspected, 47 plants pasteurize by the continuous method, 89 by the batch method, 60 by the "in bottle" method, and 1 by the can method. From the foregoing it is obvious that the practice of pasteurizing in the can has been practically abandoned. This is due to the impracticability and inefficiency of the method.

Comparing the results of the work of the year 1920 with those of the years 1918 and 1919, from the standpoint of the percentage of all recommendations made for improvements previous to or during that year which had been carried out at the close of that year, it appears that in 1918, 41.1 per cent of our recommendations had been carried out; in 1919, 46.3

per cent had been carried out; and in 1920, 49.1 per cent had been carried out. The foregoing shows that although there was an increase of 5.2 per cent in the year 1919 over the year 1918, the increase in the year 1920 over the year 1919 was only 2.8 per cent.

The accompanying table covering the work of inspections of milk pasteurizing plants is self-explanatory.

MILK PASTEURIZATION PLANTS INSPECTED IN 1920, EXCLUDING THOSE WHICH SHIP TO NEW YORK CITY

Plant No.	Location	Name	Milk in quarts handled daily	Number of dairies served by plant	Date of original inspection	Total number of recommendations made	Process used in pasteurisation	Grade after pasteurisation	Number reinspections made up to 1/1/20	Number recommendations carried out to 1/1/20	Number recommendations not carried out to 1/1/20	Number reinspections from 1/1/20 to 1/1/21	Number recommendations carried out from 1/1/20 to 1/1/21	Number recommendations not carried out to 1/1/21	Percentage improvements to 1/1/21 on basis of recommendations carried out
1	Albany*	Golding & Tompkins	3,000	36	1/17/17	32	Cont.	B	3	20	12	1	3	9	71.9
2	Albany	Rensselaer Dairy Co.	2,000	10	1/18/17	28	Batch	B	5	6	22	1	Temp	orarily	discont'd
3	Albany	The Boulevard Dairy Co.	2,800	35	8/ 8/17	14	Cont.	A & B	3	10	4	1	......	4	74.1
4	Albany	The Normanskill Farms Dairy	7,200	75	1/16/17	21	Batch	A & B	4	8	12	1	6	7	66 7
5	Amsterdam	Nadler Bros.	5,000	70	9/10/18	16	Batch	A & B	2	8	6	1	2	4	62.5
6	Amsterdam	Joseph Olbrych	1,600	13	9/10/18	15	Batch	B	3	9	6	1	......	6	60.0
7	Amsterdam	John Sager	1,000	10	7/ 6/17	22	Batch	B	4	15	7	1	......	7	68.2
8	Arcade†	Merrell-Soule Co.	45,000	500	2/11/18	4	Batch	B	1	4	......	1	4	......	100.0
9	Arkport†	Arkport Creamery Co.	4,000	100	2/15/18	16	Batch	B (cream)	2	2	14	1	......	14	12.5
10	Auburn	Auburn Sanitary Milk Co.	4,000	30	10/23/17	24	Batch	A	2	11	13	1	2	11	54.1
11	Ballston Spa	Ballston Spa Creamery Co.	6,000	150	9/23/18	20	Batch	B	3	8	12	1	......	12	40.0
12	Batavia	Warren Fargo	1,600	14	1/17/18	17	Batch	A	3	5	12	1	1	11	42.9
13	Berlin‡	Berlin Milk Cond. Co.	1,500	25	11/18/18	13	Batch	B	1	......	13	1	4	9	30.8
14	Johnson City (Binghamton)	T. W. Schoonover	1,600	11	4/17/17	21	In can	B	4	7	14	1	3	11	47.6
15	Binghamton	Cloverdale Creamery	5,500	120	4/17/17	16	Batch	B	3	5	11	1	8	3	81.2
16	Binghamton	Crowley Milk Co.	8,500	107	6/ 5/20	14	Batch	B	......	......	......	......	......	14	......
17	Binghamton	Holtailing Dairy Co.	1,900	15	6/ 7/20	14	Cont.	B	......	......	......	......	......	14	......
18	Buffalo§	Bernhard Ball	450	4	12/13/17	8	In bot.	B	2	6	2	1	1	1	87.5
19	Buffalo	T. A. Beal & Sons	3,000	27	12/21/20	6	Batch	B	......	......	......	......	......	6	......
20	Buffalo	W. H. Beal	450	5	1/ 9/18	13	Batch	A	2	4	9	1	3	6	53.8
21	Buffalo	F. W. Becker	300	3	12/16/20	11	In bot.	A	......	......	......	......	......	11	......
22	Buffalo	Paul Blessing	300	5	9/10/18	15	In bot.	B	2	9	6	1	1	5	66.6
23	Buffalo	W. W. Boynton	225	3	1/ 5/18	10	In bot.	A & B	2	5	5	1	......	5	50.0
24	Buffalo	R. A. Brown	920	9	2/13/18	15	Batch	B	2	10	5	1	1	6	33.3
25	Buffalo	G. A. Bush & Son	540	5	11/23/17	11	Batch	A	3	4	7	1	1	8	27.2
26	Buffalo	T. H. Covey & Co.	875	8	2/ 8/18	15	Cont.	B	2	8	7	1	1	8	46.6
27	Buffalo	Christopher & Riley	250	2	11/12/17	16	Batch	B	2	7	9	1	2	7	56.2
28	Buffalo	Charles H. Coley	2,200	30	1/ 7/18	14	In bot.	A & B	2	8	6	1	1	5	46.3
29	Buffalo	James Darling	480	7	2/ 9/18	11	In bot.	A	2	5	6	1	1	5	54.5
30	Buffalo	George Ditzel	420	3	11/21/17	16	Batch	A	2	7	9	1	......	9	43.7
31	Buffalo	Dodds Alderney Dairy	2,600	26	1/ 4/18	14	In bot.	A & B	2	11	3	1	......	3	78.5

32	Buffalo	David Donald	350	2	12/13/17	13	Cont.	A & B	2	7	6	1	1	7	46.1
33	Buffalo	William G. Dunn	220	5	9/10/18	14	In bot.	A	2	8	6	1	......	6	57.1
34	Buffalo	John Follett	3,200	10	12/13/17	13	Cont.	B	2	8	5	1	3	8	38.4
35	Buffalo	H. C. Geenen	480	4	1/ 7/18	18	Batch	B	2	11	7	1	3	4	77.7
36	Buffalo	F. W. Gernold	350	6	12/21/20	10	In bot.	B	......	......	......	......	......	10	......
37	Buffalo	Frank Gmereck	250	3	9/ 5/18	9	In bot.	B	2	5	4	1	2	3	66.6
38	Buffalo	F. H. Greenwald	900	13	6/ 9/19	15	Batch	A & B	......	......	......	1	4	11	26.6
39	Buffalo	Frank J. Grath	1,500	18	2/ 7/18	16	Batch	B	2	14	2	1	1	3	81.2
40	Buffalo	Peter Hagner	2,300	16	12/11/17	17	Cont.	A & B	2	9	8	1	2	6	64.7
41	Buffalo	Haid Bros.	550	5	11/20/17	18	Cont.	B	2	8	10	1	2	8	55.5
42	Buffalo	Henel Bros.	300	2	9/ 9/18	21	Batch	A	1	4	17	1	11	6	71.4
43	Buffalo	Hess & Bement	900	11	11/22/17	7	In bot.	A	2	6	1	1	......	1	85.7
44	Buffalo	J. E. Heim	400	5	12/12/17	8	In bot.	A & B	2	5	3	1	1	2	75.0
45	Buffalo	Hoen & Sturm	640	5	11/17/17	19	Batch	B	2	6	13	1	6	7	63.1
46	Buffalo	Henry Hutt	1,920	21	1/ 8/18	16	Batch	B	2	10	7	1	2	5	68.7
47	Buffalo	W. L. Johnson	800	8	1/ 3/18	10	In bot.	A & B	2	9	1	1	1	......	100.
48	Buffalo	R. W. Jones	2,880	30	11/17/17	19	Batch	A & B	2	16	3	1	......	3	84.2
49	Buffalo	M. Jasinsky	300	4	2/13/18	14	Batch	A	2	4	10	1	4	6	57.1
50	Buffalo	J. T. Lannen	400	5	11/22/17	12	In bot.	B	2	4	8	1	1	9	25.
51	Buffalo	Fred Kromke	350	3	12/16/20	11	In bot.	B	......	......	......	......	......	11	......
52	Buffalo	F. Lauterschlager	375	3	12/12/17	11	Cont.	B	2	5	6	1	2	4	63.6
53	Buffalo	Geo. Miller	200	4	12/15/20	9	In bot.	B	......	......	......	......	......	9	......
54	Buffalo	J. Mallon	320	3	2/ 8/18	14	In bot.	B	2	10	4	1	1	5	64.2
55	Buffalo	J. Milligan	450	3	1/ 9/18	14	In bot.	B	2	9	5	1	1	6	57.1
56	Buffalo	J. Niebauer	670	7	2/14/18	16	Cont.	B	2	9	7	1	2	5	68.7
57	Buffalo	S. F. Olesniesak	250	3	11/18/19	10	In bot.	B	......	......	......	1	2	8	20.0
58	Buffalo	Thomas Osborn	580	6	9/ 7/18	18	Batch	B	2	14	4	1	3	7	61.1
59	Buffalo	Orlowsky Milk Co.	800	8	2/11/18	16	Cont.	B	2	7	9	1	2	7	56.2
60	Buffalo	People's Milk Co.	17,000	75	11/20/17	9	Cont.	A & B	2	4	5	1	1	4	55.5
61	Buffalo	C. G. Pfau	160	1	2/ 7/18	11	In bot.	B	2	5	6	1	......	6	45.4
62	Buffalo	A. E. Pirk	200	1	9/10/18	17	In bot.	B	2	12	5	1	......	5	70.5
63	Buffalo	G. Puerner	300	5	2/ 6/18	12	In bot.	B	2	7	5	1	1	4	66.6
64	Buffalo	C. A. Puff	4,000	25	11/22/17	17	Batch	B	2	8	9	1	4	5	70.5
65	Buffalo	Rasp & Miller	475	7	2/11/18	16	Cont.	B	2	8	8	1	2	10	37.5
66	Buffalo	J. Repschlager	600	7	11/21/17	12	In bot.	B	2	10	2	1	1	3	75.0
67	Buffalo	T. M. Rockwood	250	3	1/ 9/18	12	In bot.	A	2	6	6	1	1	5	58.3
68	Buffalo	Geo. Rolling	400	4	11/24/17	15	In bot.	A	2	8	7	1	1	6	60.0
69	Buffalo	R. Sauerwein	1,000	12	1/ 8/18	14	In bot.	A & B	2	9	5	1	2	3	78.5
70	Buffalo	Louis Schafer	300	4	11/19/19	7	In bot.	B	......	......	......	1	4	3	57.1
71	Buffalo	A. A. Schreiber	500	8	2/11/18	15	Batch	B	2	3	12	1	3	9	40.0
72	Buffalo	Scotland Pugh	350	3	1/ 4/18	12	In bot.	A & B	2	7	5	1	3	2	83.3
73	Buffalo	Louis Seibert	250	3	2/13/18	18	In bot.	B	2	13	5	1	2	7	61.1
74	Buffalo	Gottlieb Seibert	800	8	2/ 6/18	15	Batch	B	2	11	4	1	1	3	80.0
75	Buffalo	William C. Seibert	300	4	12/ 6/20	6	Batch	A & B	......	......	......	......	......	6	......
76	Buffalo	G. W. Shero	480	5	11/22/17	18	Cont.	A & B	2	11	7	1	1	8	55.5
77	Buffalo	W. W. Shoemaker	600	6	11/22/17	10	In bot.	A & B	2	8	2	1	......	2	80.0

* Now branch of the Boulevard Dairy Co. of Albany.
† Milk separated and cream pasteurized.
‡ Now branch of the Normanskill Farms Dairy.
§ Plants inspected at the end of 1920 but not reported upon.

MILK PASTEURIZATION PLANTS INSPECTED IN 1920, EXCLUDING THOSE WHICH SHIP TO NEW YORK CITY — (*Continued*)

Plant No.	Location	Name	Milk in quarts handled daily	Number of dairies served by plant	Date of original inspection	Total number of recommendations made	Process used in pasteurization	Grade after pasteurization	Number reinspections made up to 1/1/20	Number recommendations carried out to 1/1/20	Number recommendations not carried out to 1/1/20	Number reinspections from 1/1/20 to 1/1/21	Number recommendations carried out from 1/1/20 to 1/1/21	Number recommendations not carried out to 1/1/21	Percentage improvements to 1/1/21 on basis of recommendations carried out
78	Buffalo	J. M. Sparks	13,000	51	11/23/17	17	Batch	B	2	9	8	1	1	7	58.8
79	Buffalo	Henry Sprenger	640	6	12/15/20	10	Cont.	B	......	......	......	......	......	10	......
80	Buffalo	Oscar Steffan	675	8	1 8/18/	21	Batch	B	2	12	9	1	4	5	76.1
81	Buffalo	W. F. Steffan	600	7	1/21/17	14	Batch	B	2	4	10	1	4	6	57.1
82	Buffalo	Stock Farm Dairy Co.	1,000	4	11/16/17	18	Batch	B	2	11	7	1	1	8	55.5
83	Buffalo	M. Strobel	1,900	28	11/13/19	6	Cont.	B	......	......	......	1	1	5	16.6
84	Buffalo	Stanley Sulkowsky	300	4	2/ 8/18	10	In bot.	B	2	6	4	1	2	2	80.0
85	Buffalo	Swiss Dairy	225	2	12/14/17	14	In bot.	B	2	8	6	1	......	6	57.1
86	Buffalo	J. Szalankiewitz	350	5	2/ 8/18	14	In bot.	A & B	2	7	7	1	3	4	71.3
87	Buffalo	J. Tagliarino	800	9	1/ 7/18	17	Batch	A	2	11	6	1	3	3	82.2
88	Buffalo	W. A. Targe	250	2	11/15/17	14	In bot.	A & B	2	8	6	1	2	4	71.3
89	Buffalo	Louis Taylor	600	10	2/11/18	12	In bot.	B	2	10	2	1	2	4	66.6
90	Buffalo	William Toy	200	3	12/15/20	8	In bot.	B	......	......	......	......	......	8	......
91	Buffalo	Vanderbless Bros.	640	7	12/13/17	13	Cont.	A & B	2	10	3	1	1	2	84.6
92	Buffalo	Edward Vollman	320	2	12/23/20	15	In bot.	B	......	......	......	......	......	15	......
93	Buffalo	Hermann Van Dyke	350	3	9/ 5/18	16	In bot.	A & B	2	9	7	1	2	9	43.7
94	Buffalo	Stanley Wargula	300	3	11/18/19	11	In bot.	B	......	......	......	1	3	8	27.2
95	Buffalo	A. Wilke	960	10	5/22/19	10	Batch	B	......	......	......	1	1	9	10.0
96	Buffalo	William Weckerle	3,200	30	11/14/17	13	Cont.	B	2	10	3	1	2	1	92.3
97	Buffalo	Wilbert Milk Co.	1,100	11	2/13/18	12	In bot.	A & B	2	7	5	1	2	3	75.0
98	Buffalo	J. Yahrstorfer	375	4	1/11/18	15	Cont.	A & B	2	7	8	1	1	7	53.3
99	Canandaigua	Big Elm Dairy	800	7	4/27/20	9	Cont.	B	......	......	......	......	......	7	......
100	Collins	Pure Gold Ice Cream Co.	400	9	4/29/20	13	Batch	A	......	......	......	......	......	13	......
101	Corning	W. H. Mann	1,500	15	3/20/17	21	Batch	B	3	11	10	1	......	10	52.4
102	Colden	Queen City Dairy Co.	5,000	95	10/ 8/18	16	Cont.	B	1	4	12	1	9	3	81.3
103	East Aurora	Queen City Dairy Co.	6,500	66	1/21/18	13	Batch	B	1	7	6	1	5	1	92.3
104	Elmira	Atwater Bros.	1,300	6	3/20/17	16	Batch	A	3	8	8	1	4	4	75.0

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